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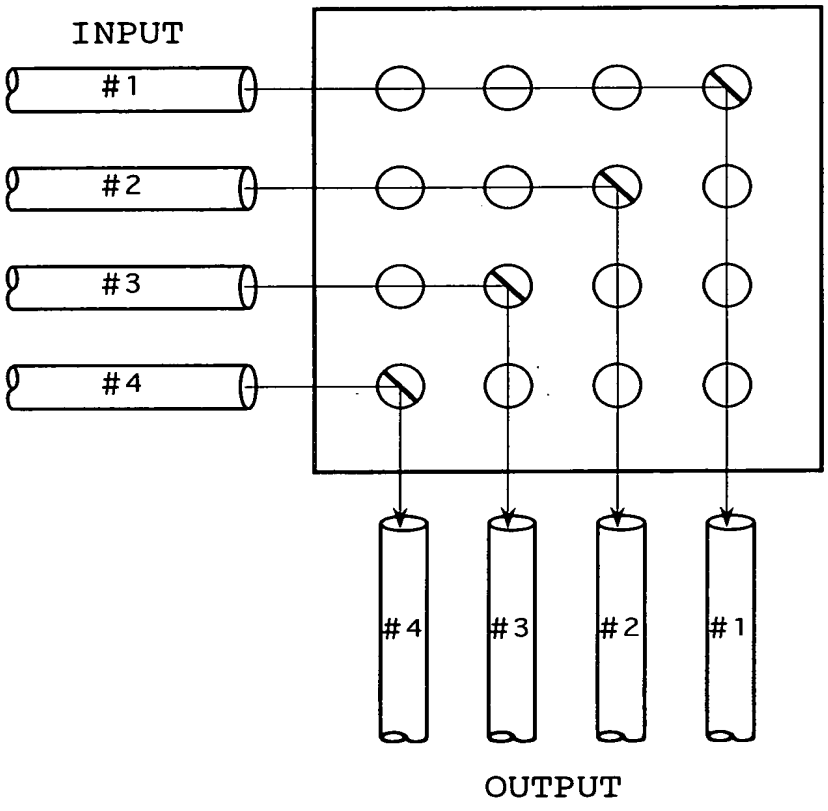
JP03804906 : 09/24/06

FIG. 1
PRIOR ART



⊘ ; SWITCH CELL (ON STATE; MIRROR INSERTED)

○ ; SWITCH CELL (OFF STATE; MIRROR NOT INSERTED)

FIG.2

PRIOR ART

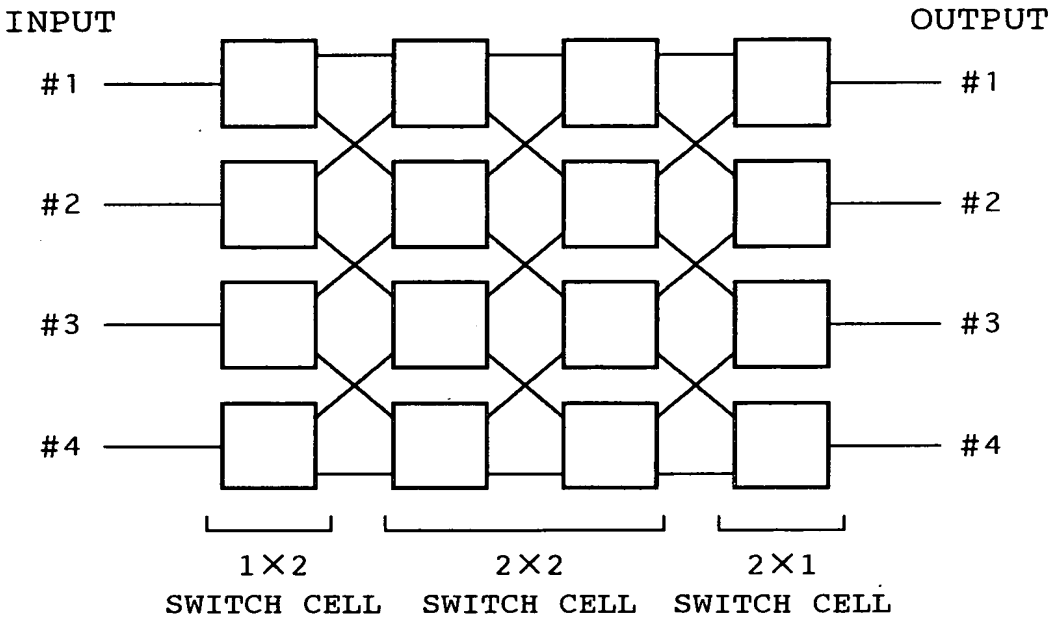


FIG.3

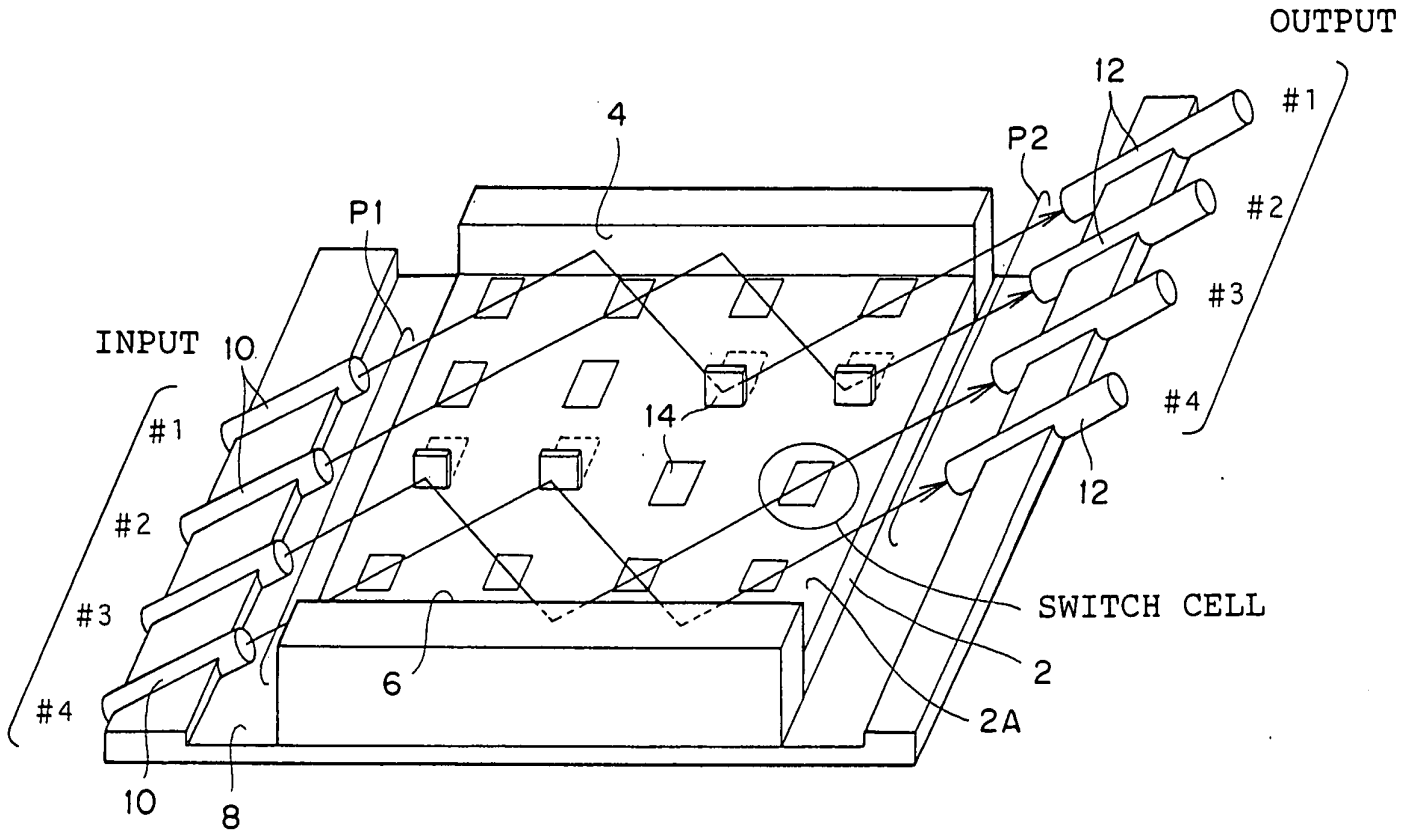


FIG.4A

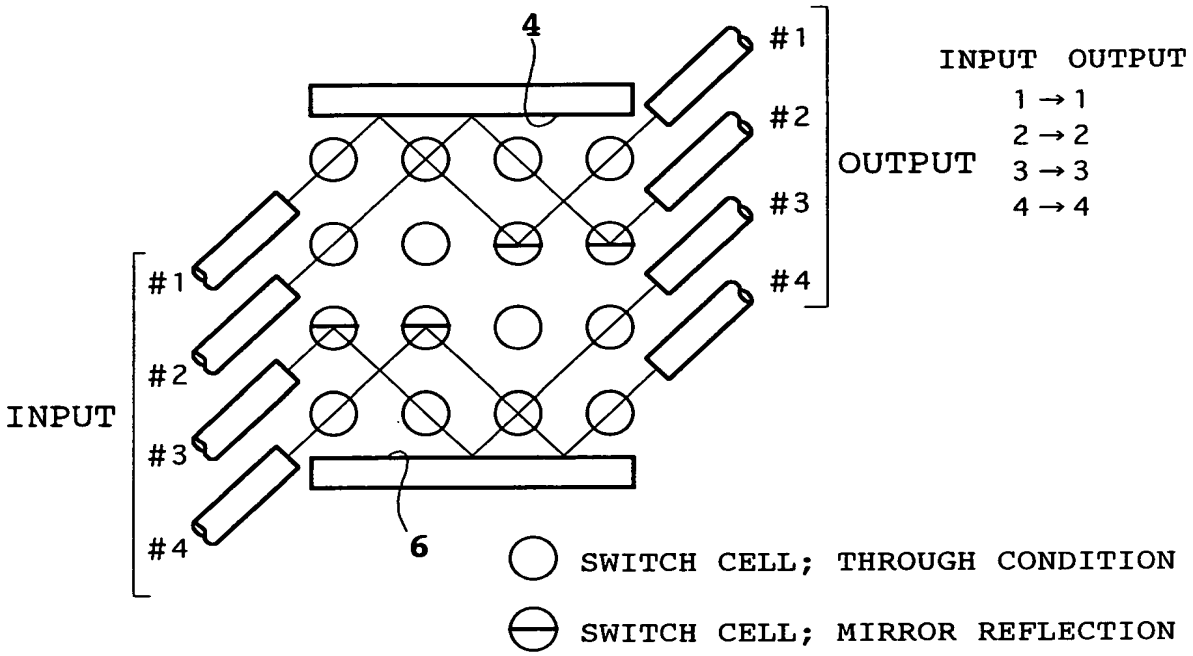

4
#1
#2
#3
#4
OUTPUT
INPUT OUTPUT
1 → 1
2 → 2
3 → 3
4 → 4
INPUT
#1
#2
#3
#4
6
SWITCH CELL; THROUGH CONDITION
SWITCH CELL; MIRROR REFLECTION

FIG.4B

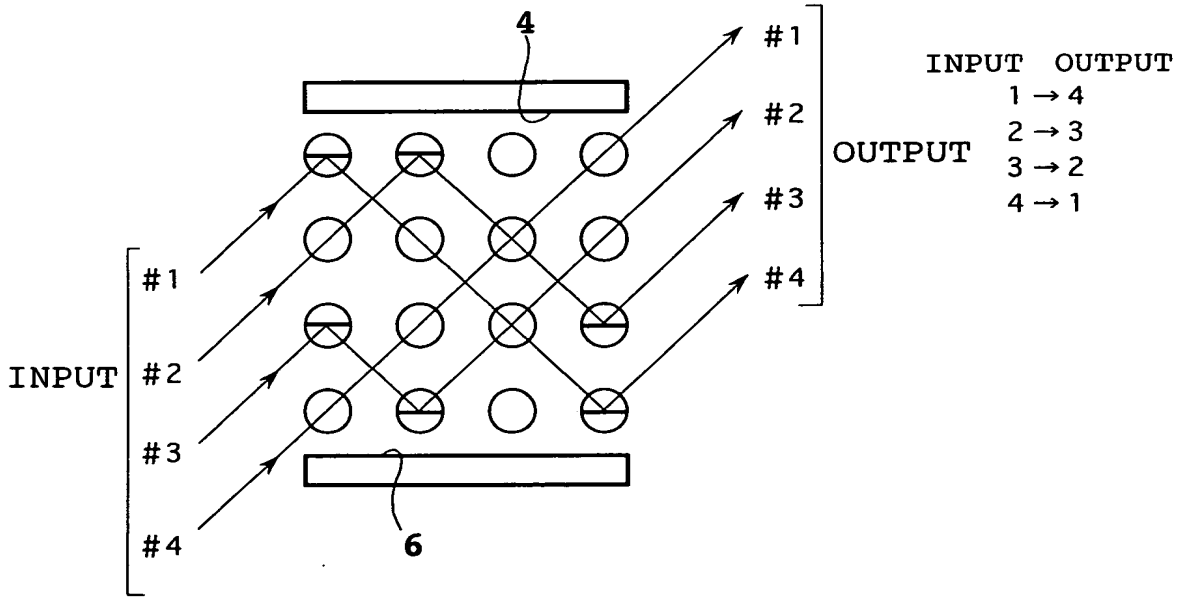

4
#1
#2
#3
#4
OUTPUT
INPUT OUTPUT
1 → 4
2 → 3
3 → 2
4 → 1
INPUT
#1
#2
#3
#4
6

FIG.5

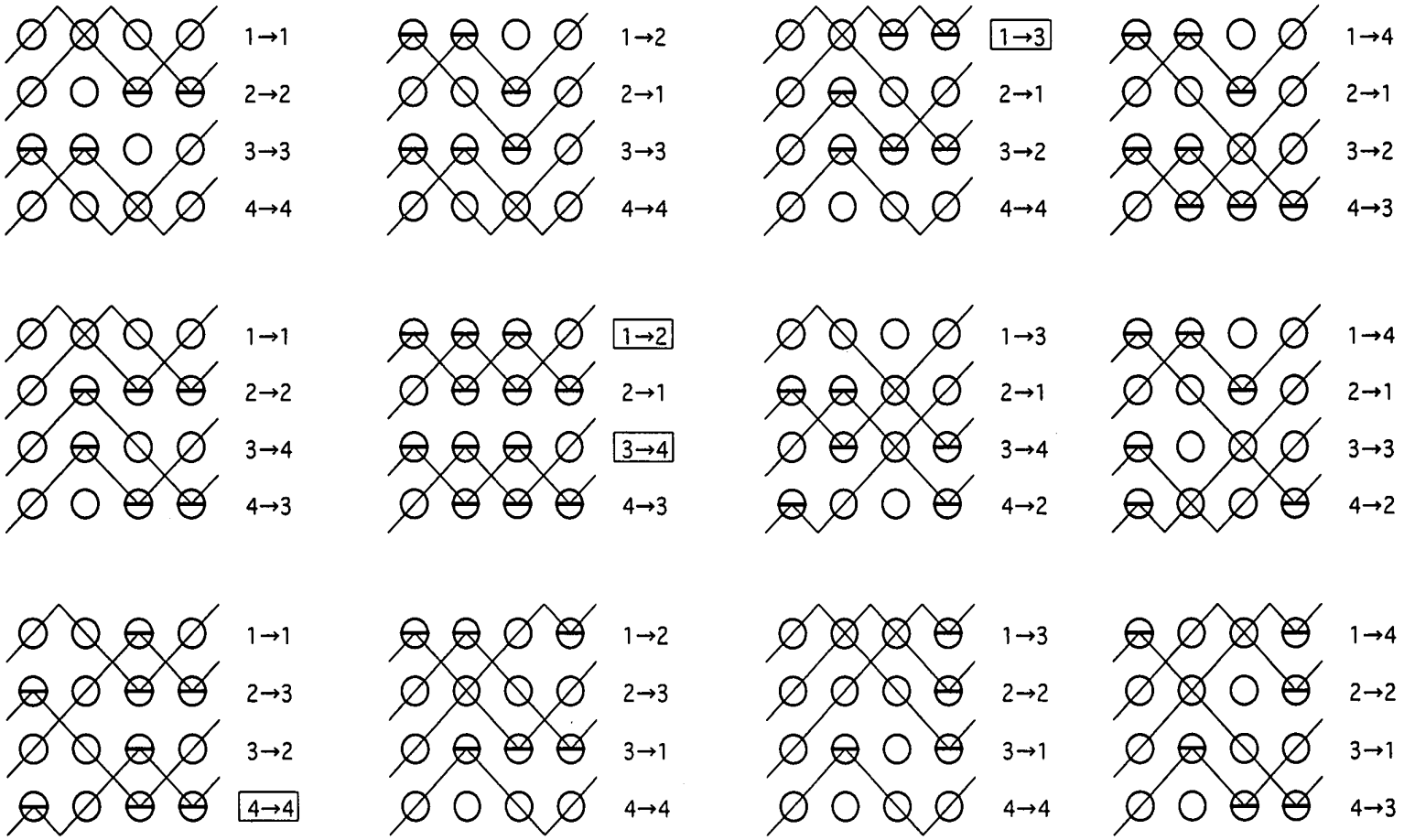
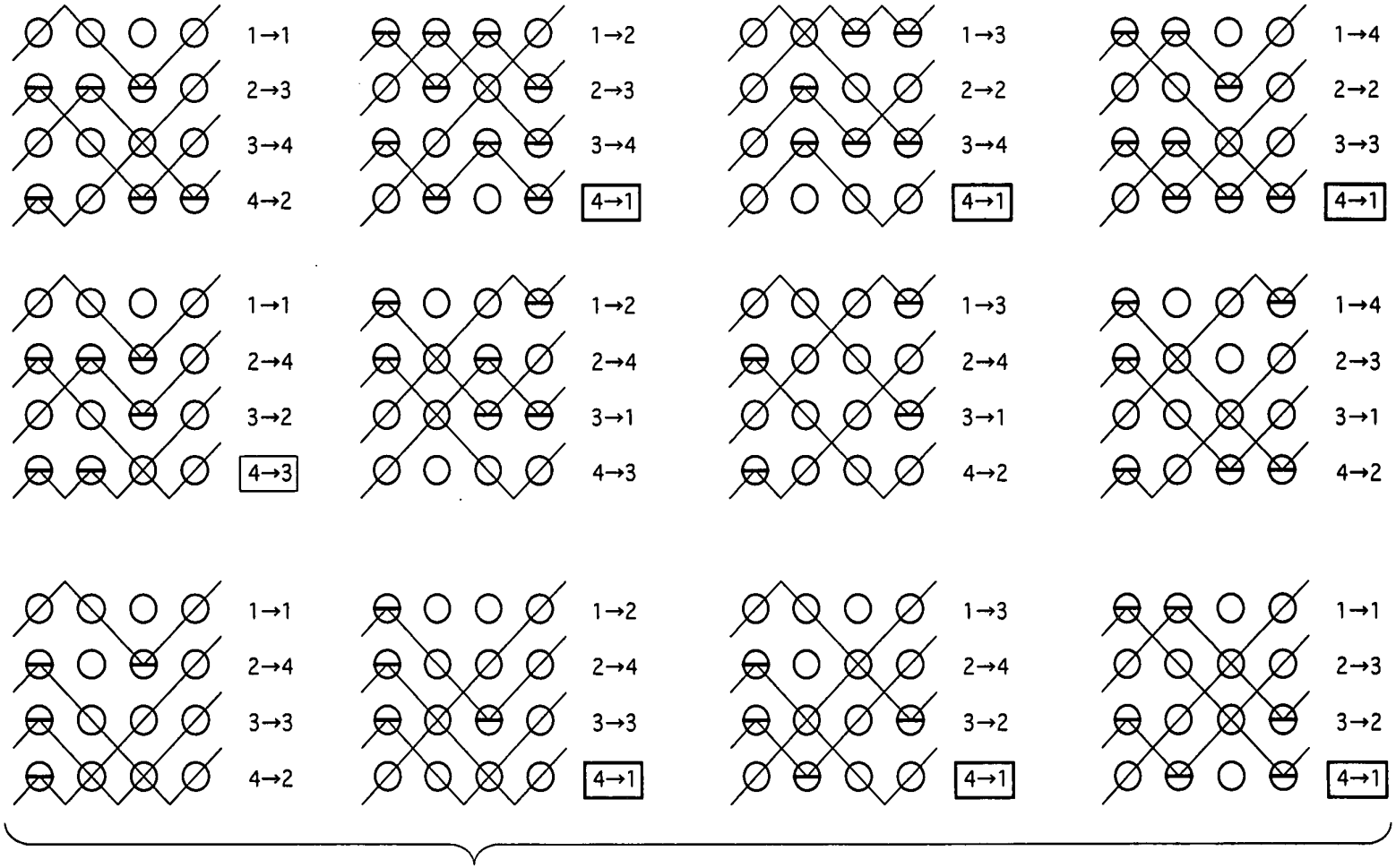
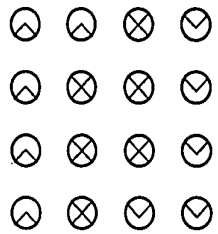

1→1
2→2
3→3
4→4
1→2
2→1
3→3
4→4
1→3
2→1
3→2
4→4
1→4
2→1
3→2
4→3
1→1
2→2
3→4
4→3
1→2
2→1
3→4
4→3
1→3
2→1
3→4
4→2
1→4
2→1
3→3
4→2
1→1
2→3
3→2
4→4
1→2
2→3
3→1
4→4
1→3
2→2
3→1
4→4
1→4
2→2
3→1
4→3

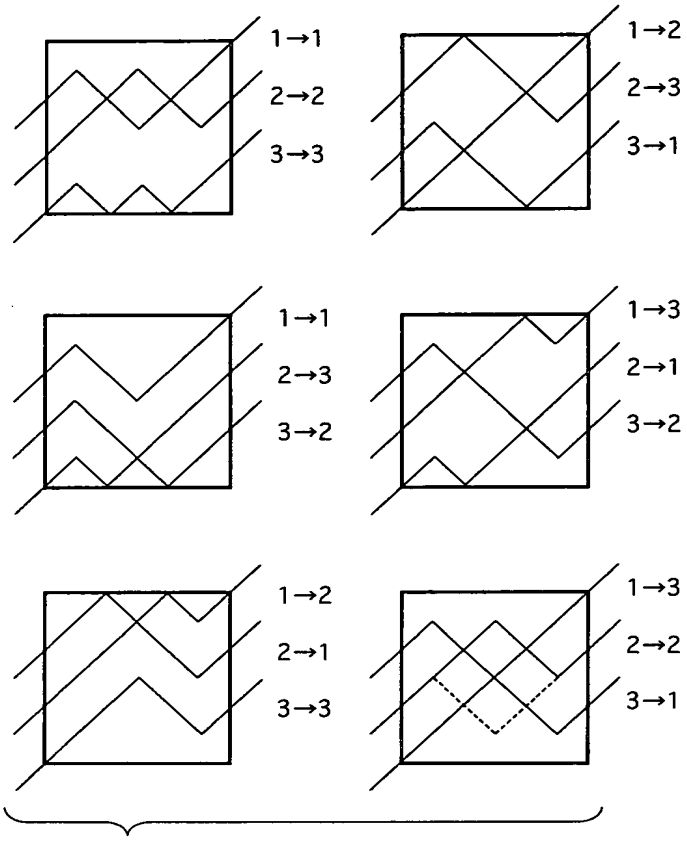
FIG.6





SIZE;4 x4
NUMBER OF CELLS;16
OPTICAL PATH LENGTH;4
NUMBER OF REFLECTIONS;2/4/0
KINDS OF MIRRORS;DOWNWARD REFLECTION;5
UPWARD REFLECTION;5
BIDIRECTIONAL REFLECTION;6

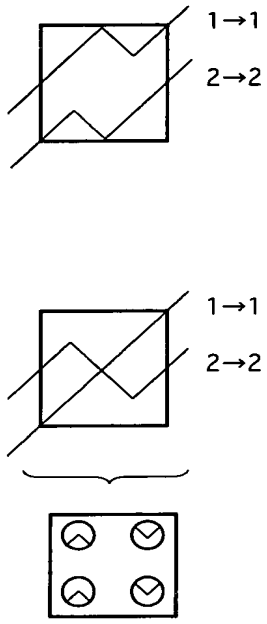
FIG.7A



SIZE;3 x 3
OPTICAL PATH LENGTH ;3
NUMBER OF REFLECTIONS;2/4/0
KINDS OF MIRRORS;UPWARD REFLECTIN;4
DOWNWARD REFLECTION;4
BIDIRECTIONAL REFLECTION;1
NUMBER OFCELLS;9

3 x 3 OPTICAL SWITCH

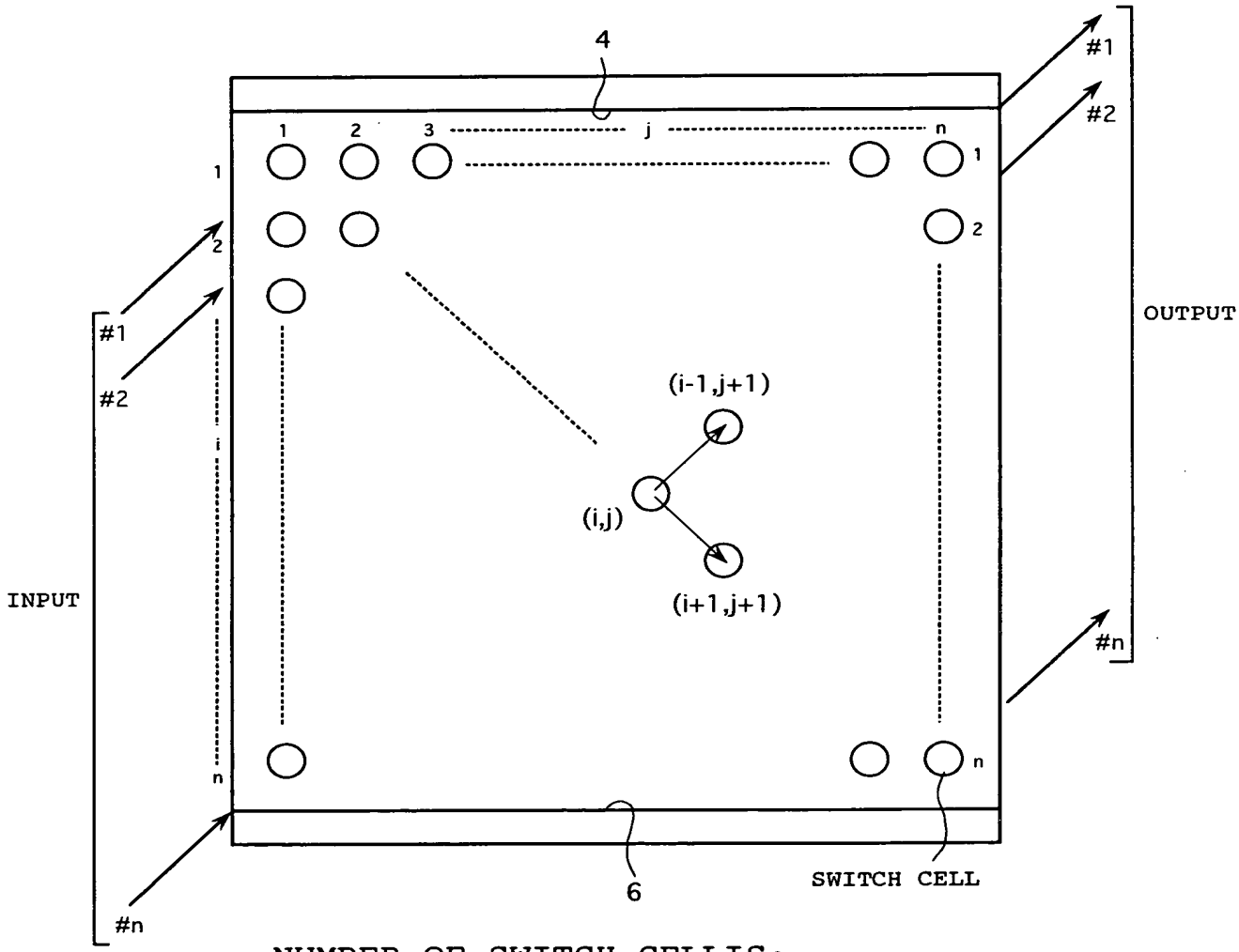
FIG.7B



SIZE;2 x 2
OPTICAL PATH LENGTH ;2NUMBER OF
REFLECTIONS;2/1
KINDS OF MIRRORS;UPWARD REFLECTIN;2
DOWNWARD REFLECTION;2
NUMBER OFCELLS;4

2 x 2 OPTICAL SWITCH

FIG.8

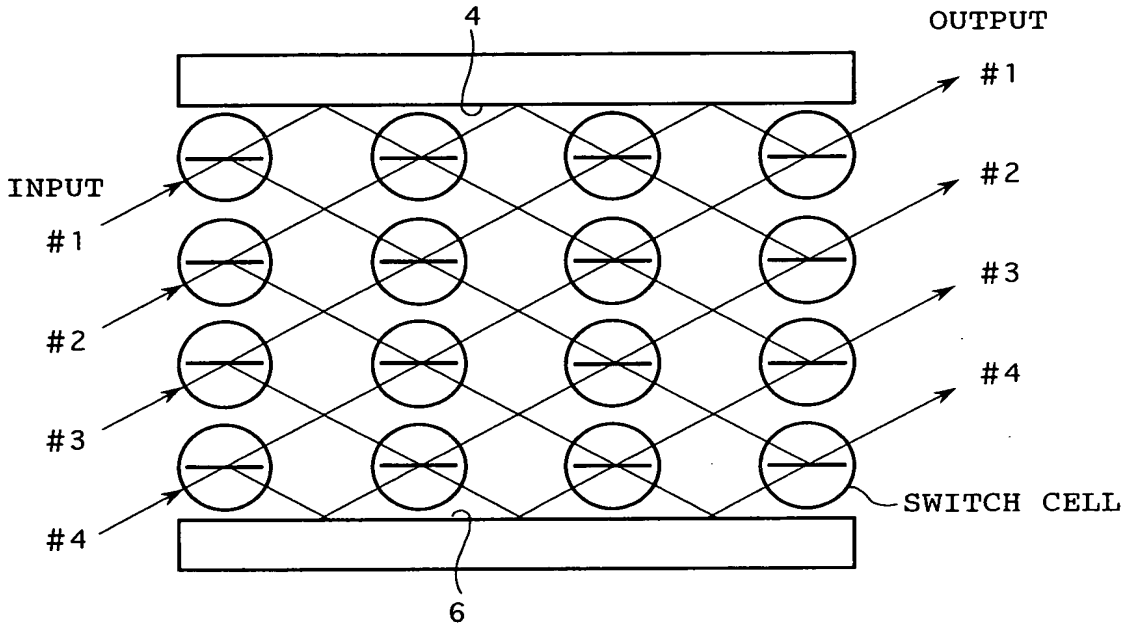


NUMBER OF SWITCH CELLIS;

UPWARD REFLECTION; n+1
DOWNWARD REFLECTION; n+1
BIDIRECTIONAL REFLECTION; n^2-2n-2
TOTAL NUMBER; n^2

EP 0 694 805 A1

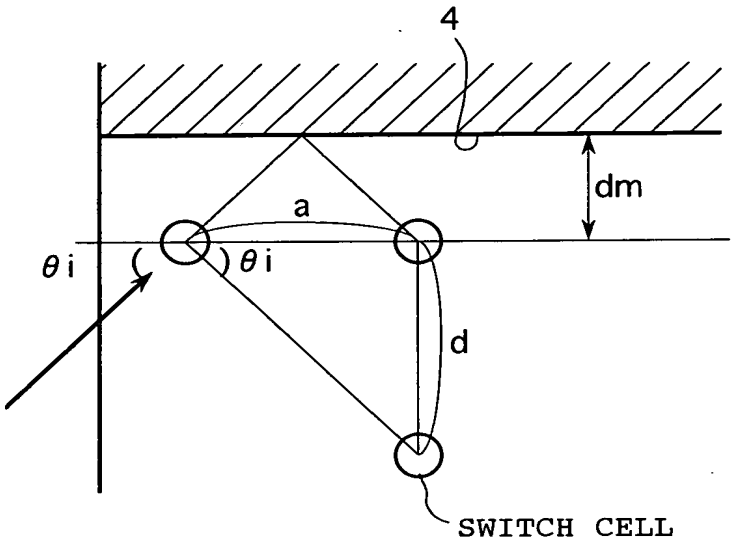
FIG.9



ANGLE OF INCIDENCE; 30°

09924606 - 080901

FIG.10



$$d = a \cdot \tan\theta i$$

$$dm = 1/2 \cdot a \cdot \tan\theta i$$

FIG.11

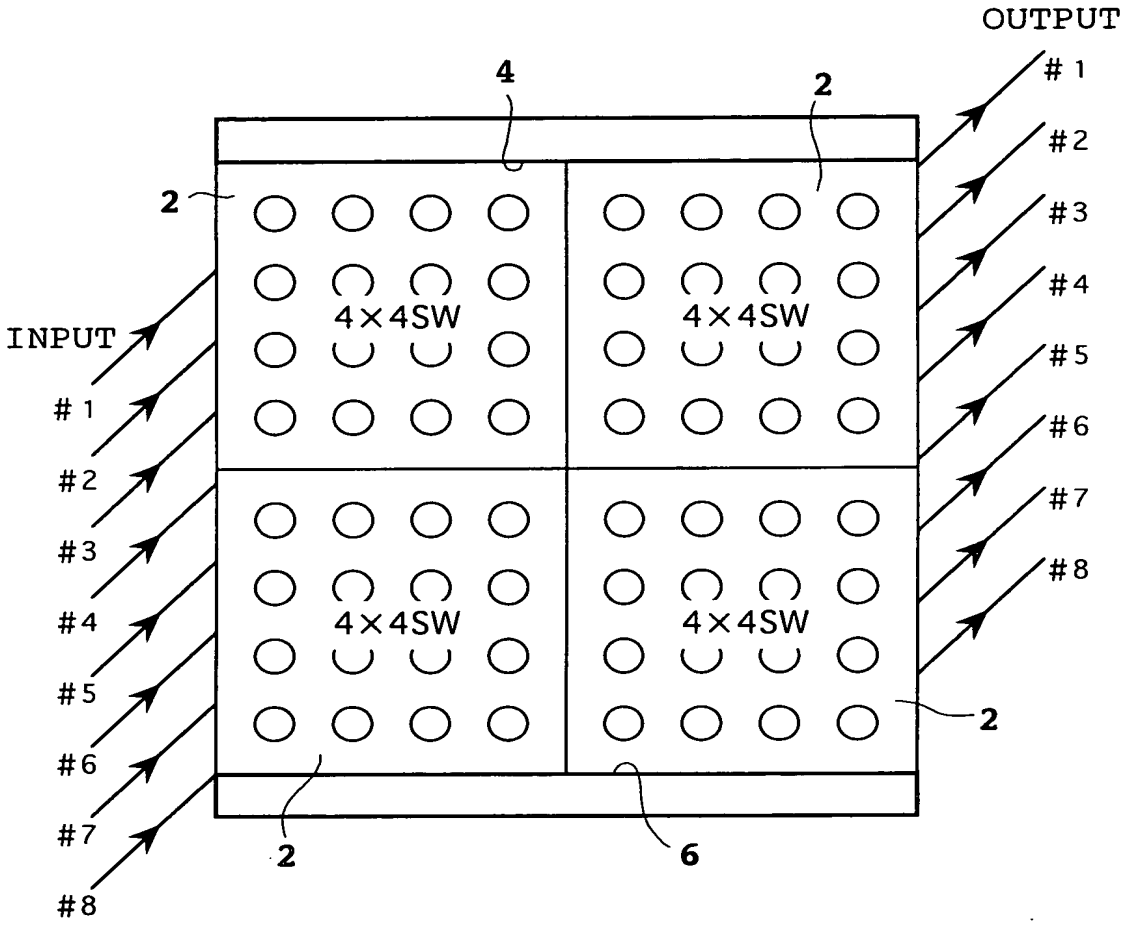


FIG.12A

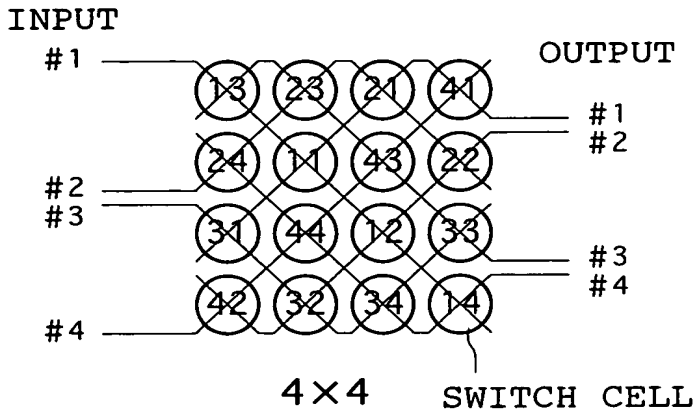
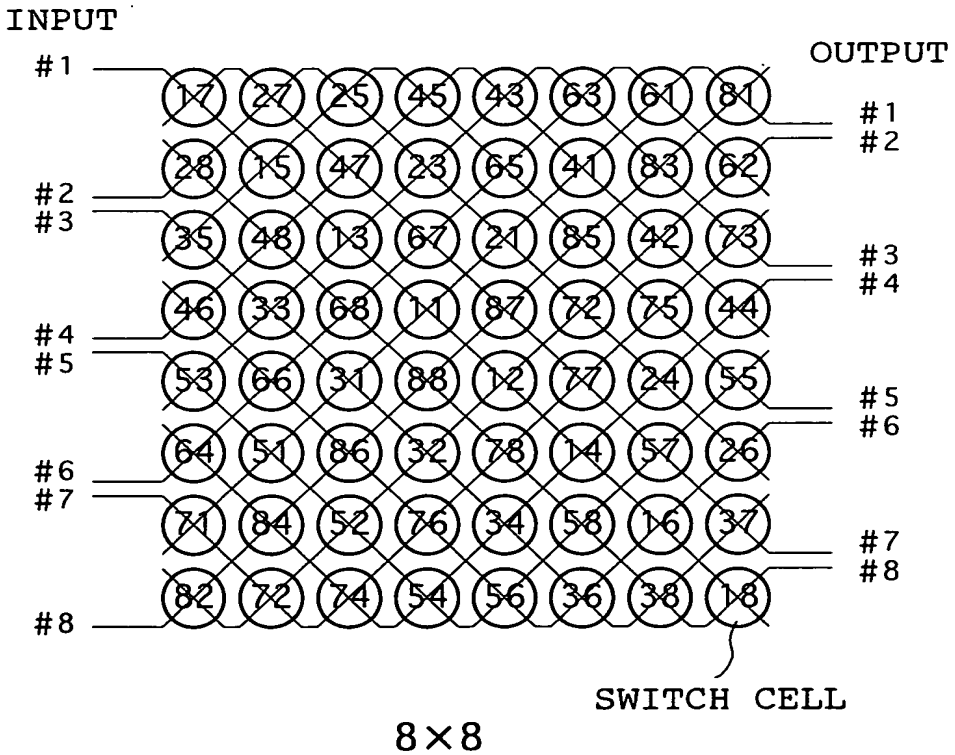


FIG.12B



09246506 - 080801

FIG.13A

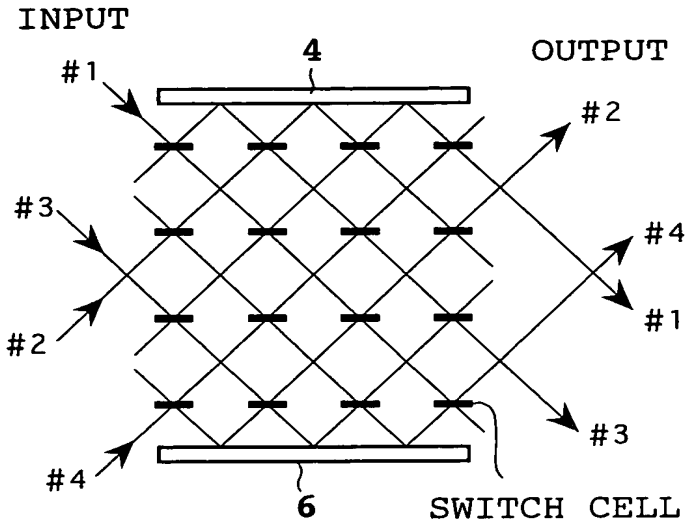
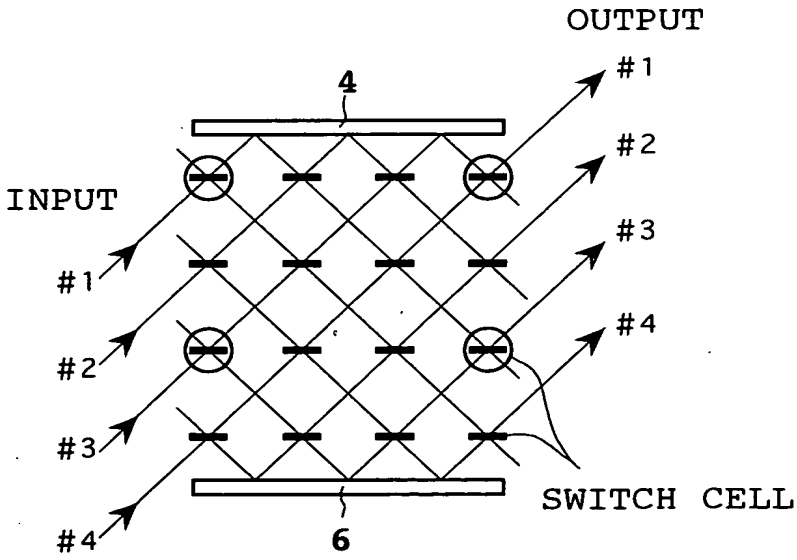


FIG.13B



EP 0 892 560 A1

FIG.14A

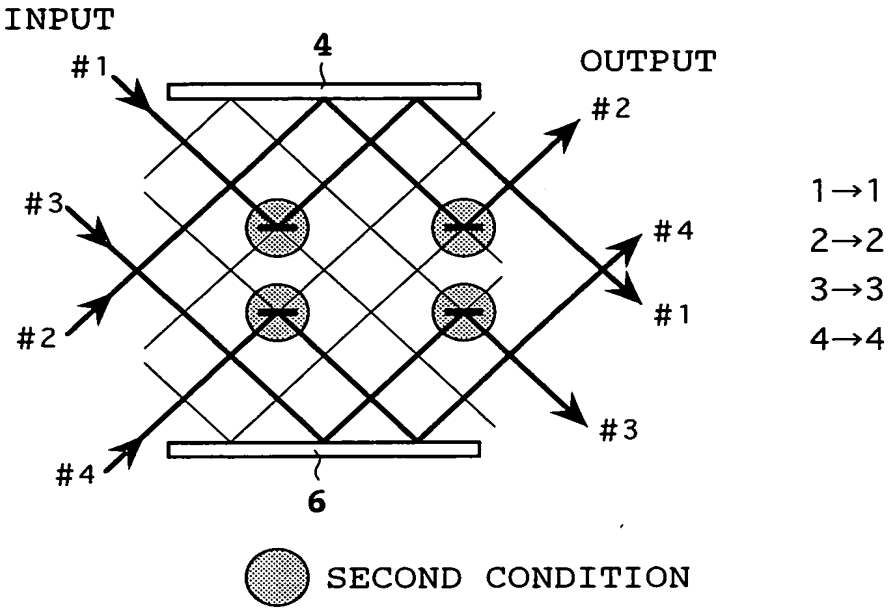
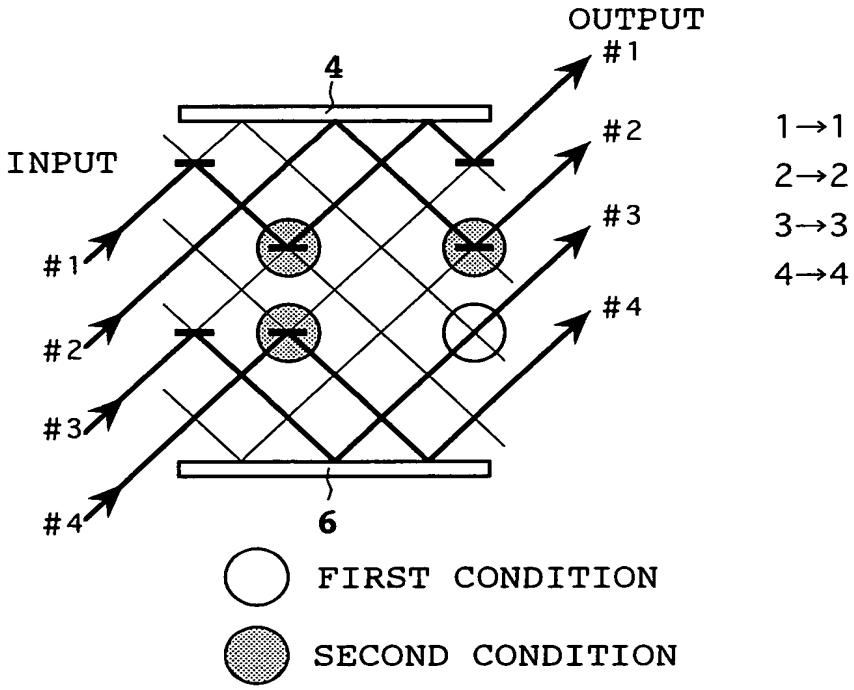


FIG.14B



EP 0 809 409 A1

FIG.15

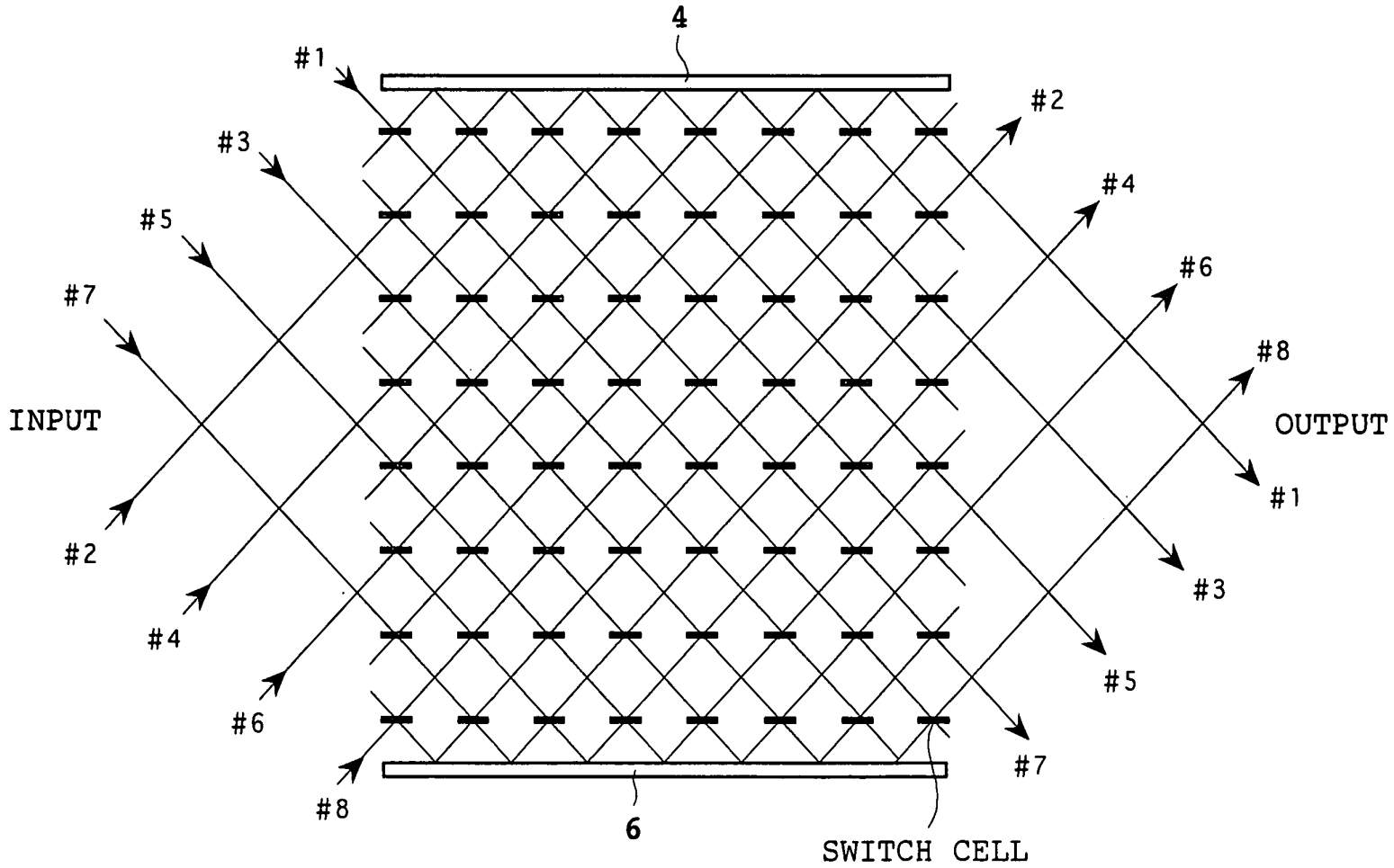


FIG.16

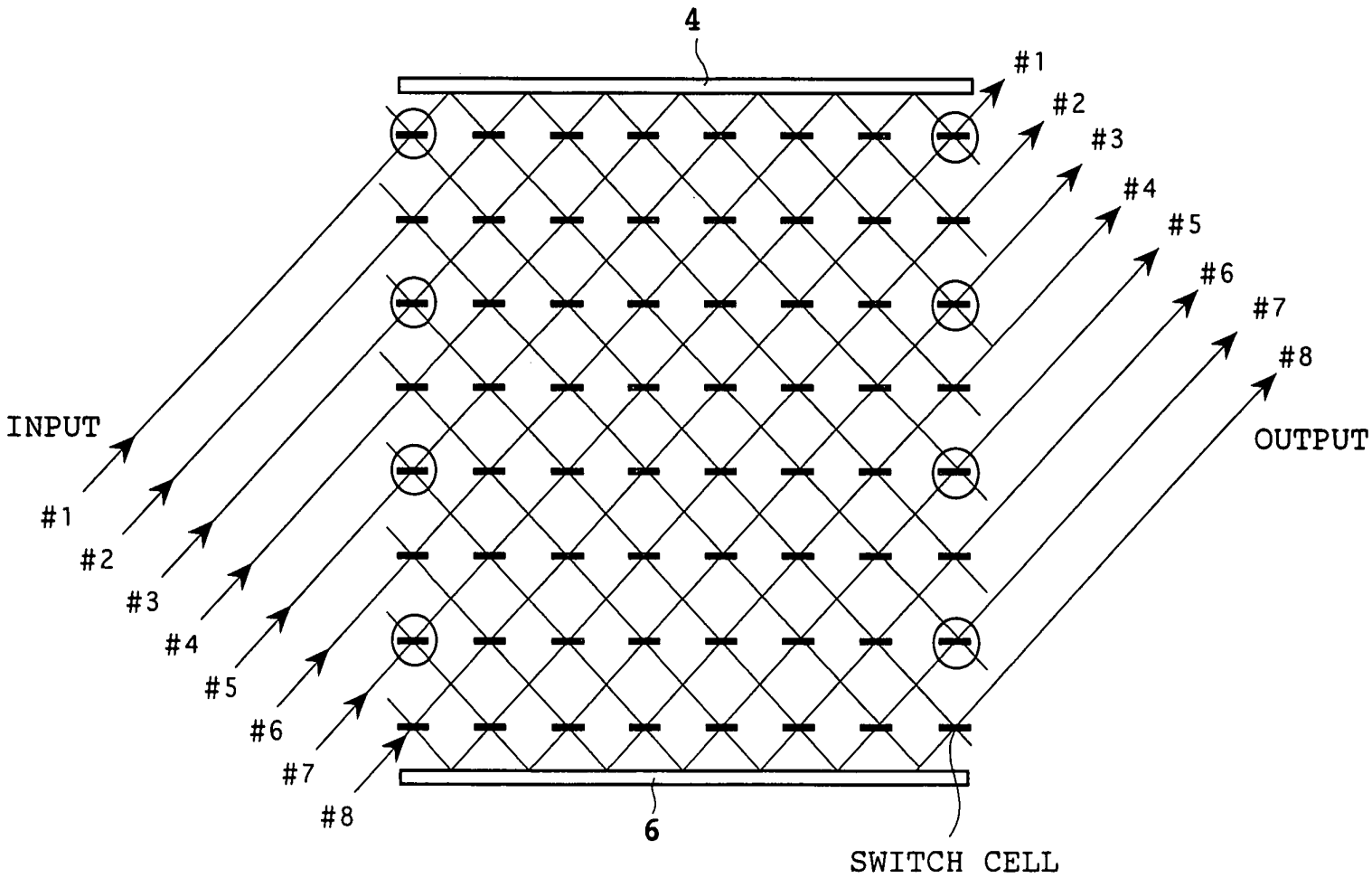


FIG.17A

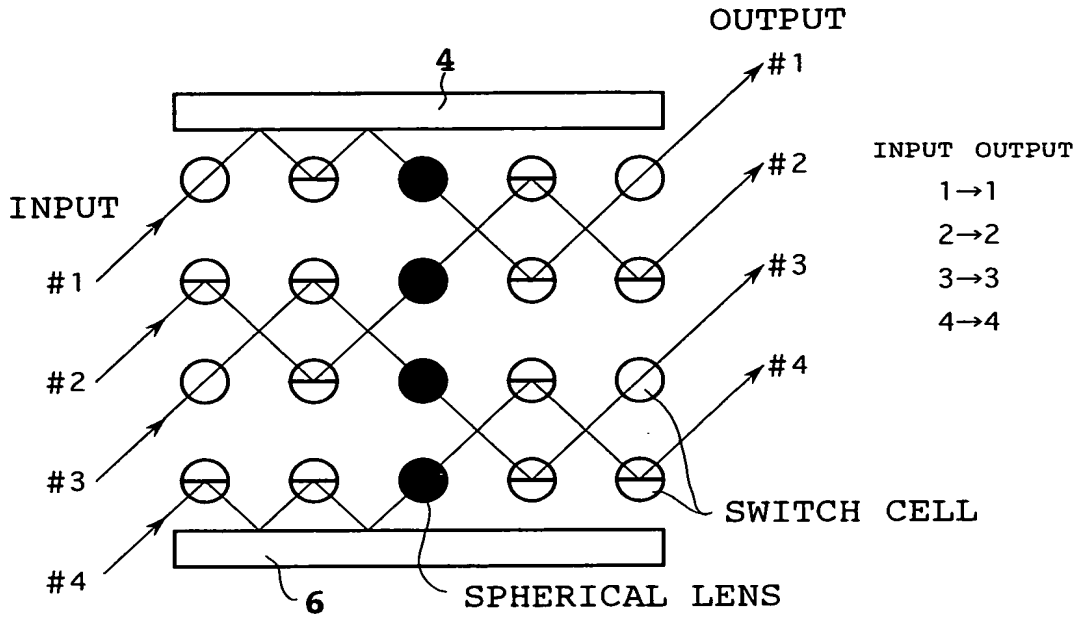


FIG.17B

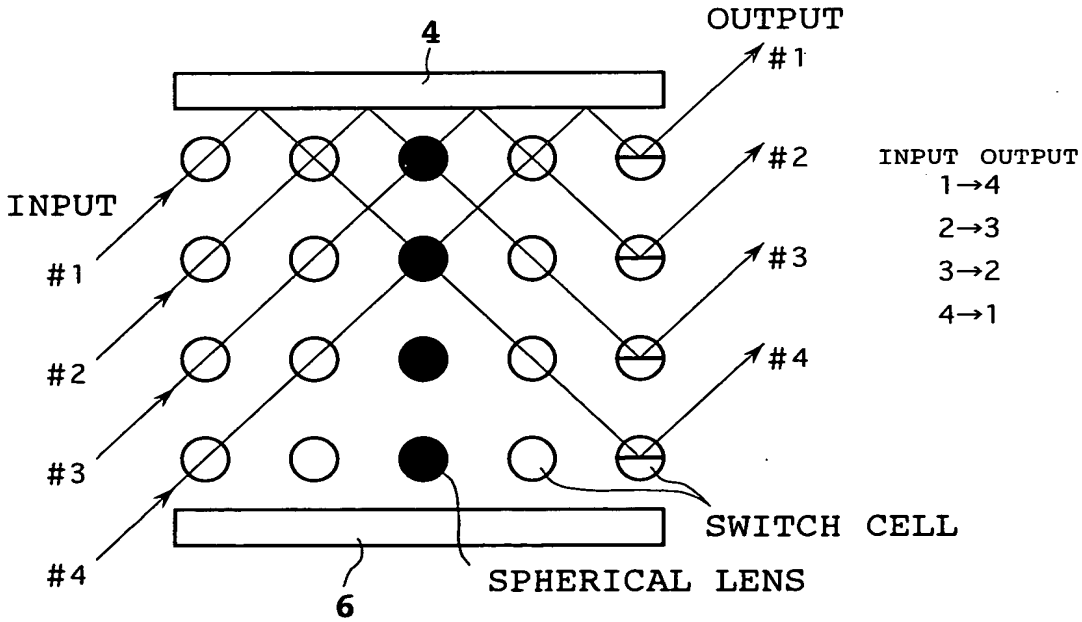


FIG.18

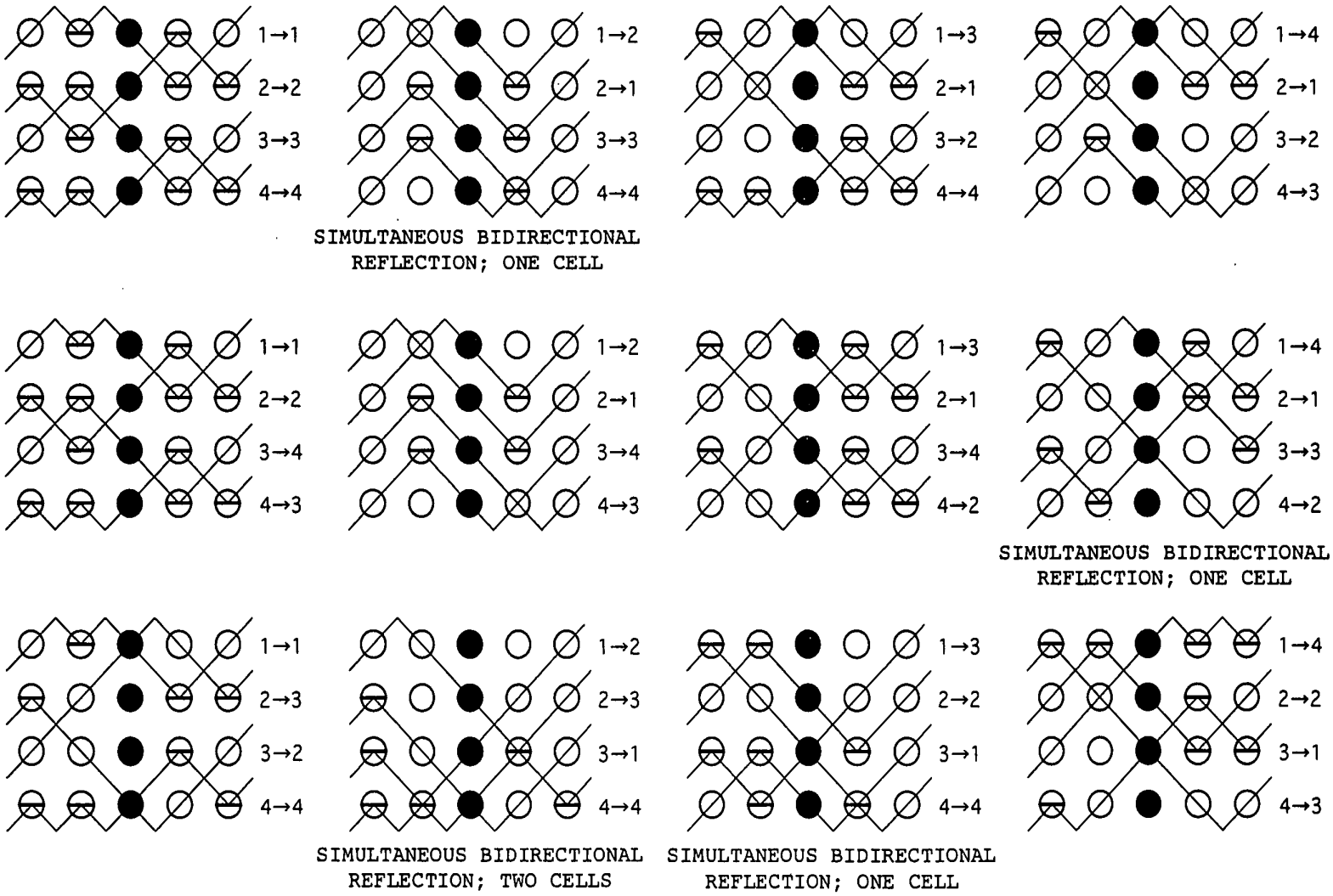

1→1
2→2
3→3
4→4
1→2
2→1
3→3
4→4
1→3
2→1
3→2
4→4
1→4
2→1
3→2
4→3
SIMULTANEOUS BIDIRECTIONAL REFLECTION; ONE CELL
1→1
2→2
3→4
4→3
1→2
2→1
3→4
4→3
1→3
2→1
3→4
4→2
1→4
2→1
3→3
4→2
SIMULTANEOUS BIDIRECTIONAL REFLECTION; ONE CELL
1→1
2→3
3→2
4→4
1→2
2→3
3→1
4→4
SIMULTANEOUS BIDIRECTIONAL REFLECTION; TWO CELLS
1→3
2→2
3→1
4→4
1→4
2→2
3→1
4→3
SIMULTANEOUS BIDIRECTIONAL REFLECTION; ONE CELL

FIG.19

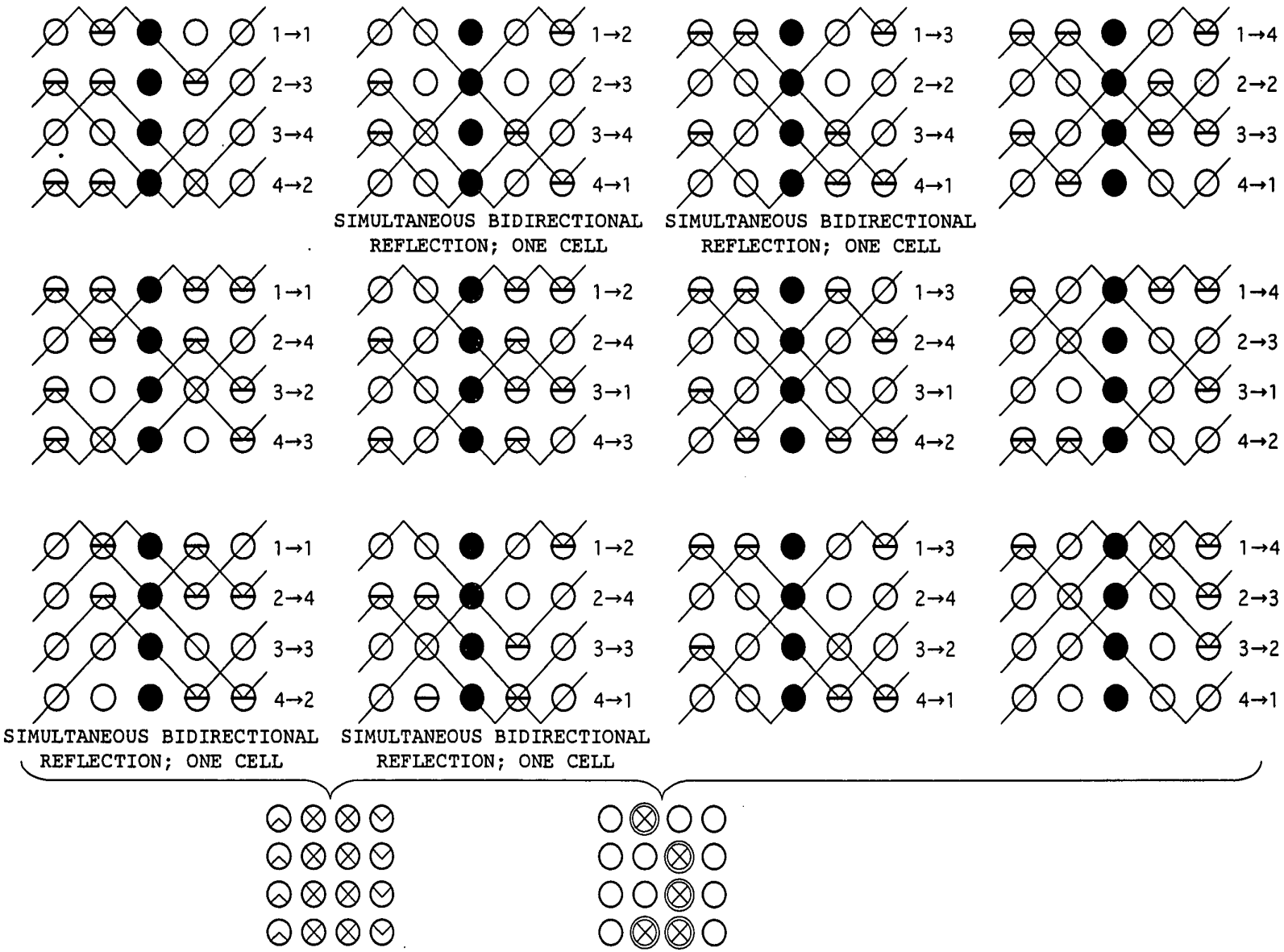
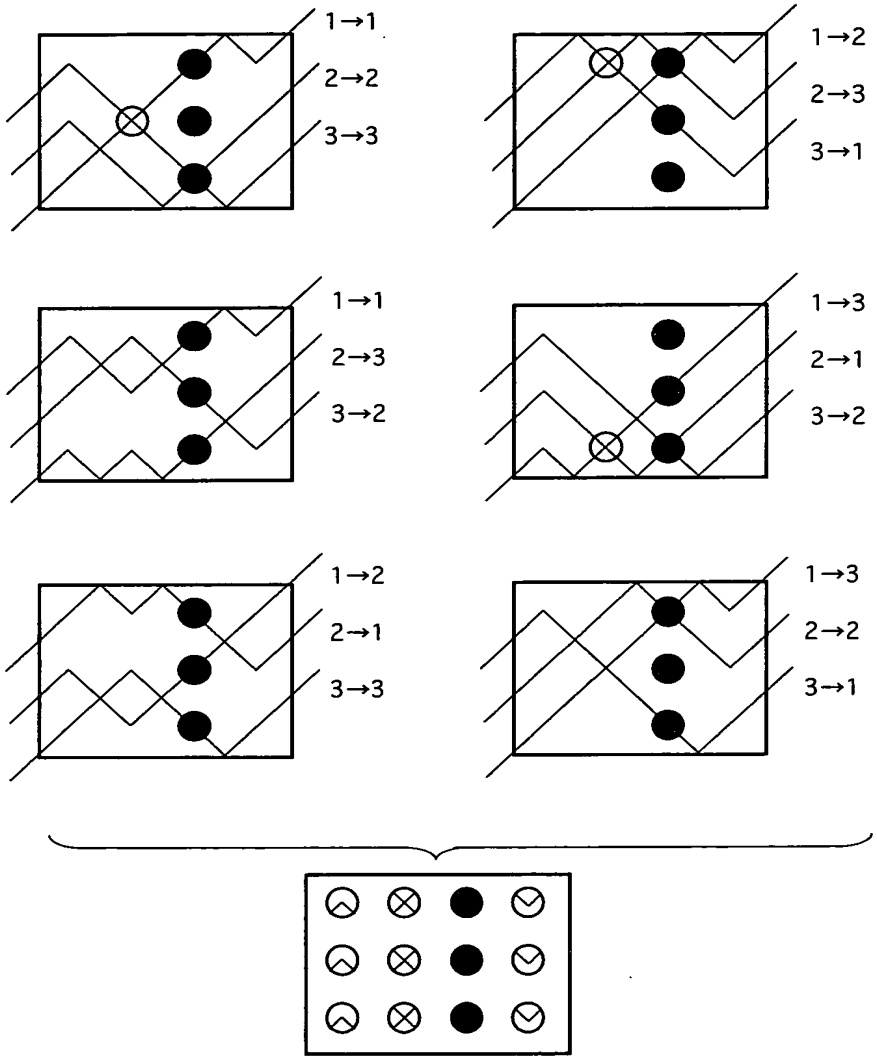

1→1
2→3
3→4
4→2
1→2
2→3
3→4
4→1
SIMULTANEOUS BIDIRECTIONAL REFLECTION; ONE CELL
1→3
2→2
3→4
4→1
SIMULTANEOUS BIDIRECTIONAL REFLECTION; ONE CELL
1→4
2→2
3→3
4→1
1→1
2→4
3→2
4→3
1→2
2→4
3→1
4→3
1→3
2→4
3→1
4→2
1→4
2→3
3→1
4→2
1→1
2→4
3→3
4→2
SIMULTANEOUS BIDIRECTIONAL REFLECTION; ONE CELL
1→2
2→4
3→3
4→1
SIMULTANEOUS BIDIRECTIONAL REFLECTION; ONE CELL
1→3
2→4
3→2
4→1
1→4
2→3
3→2
4→1

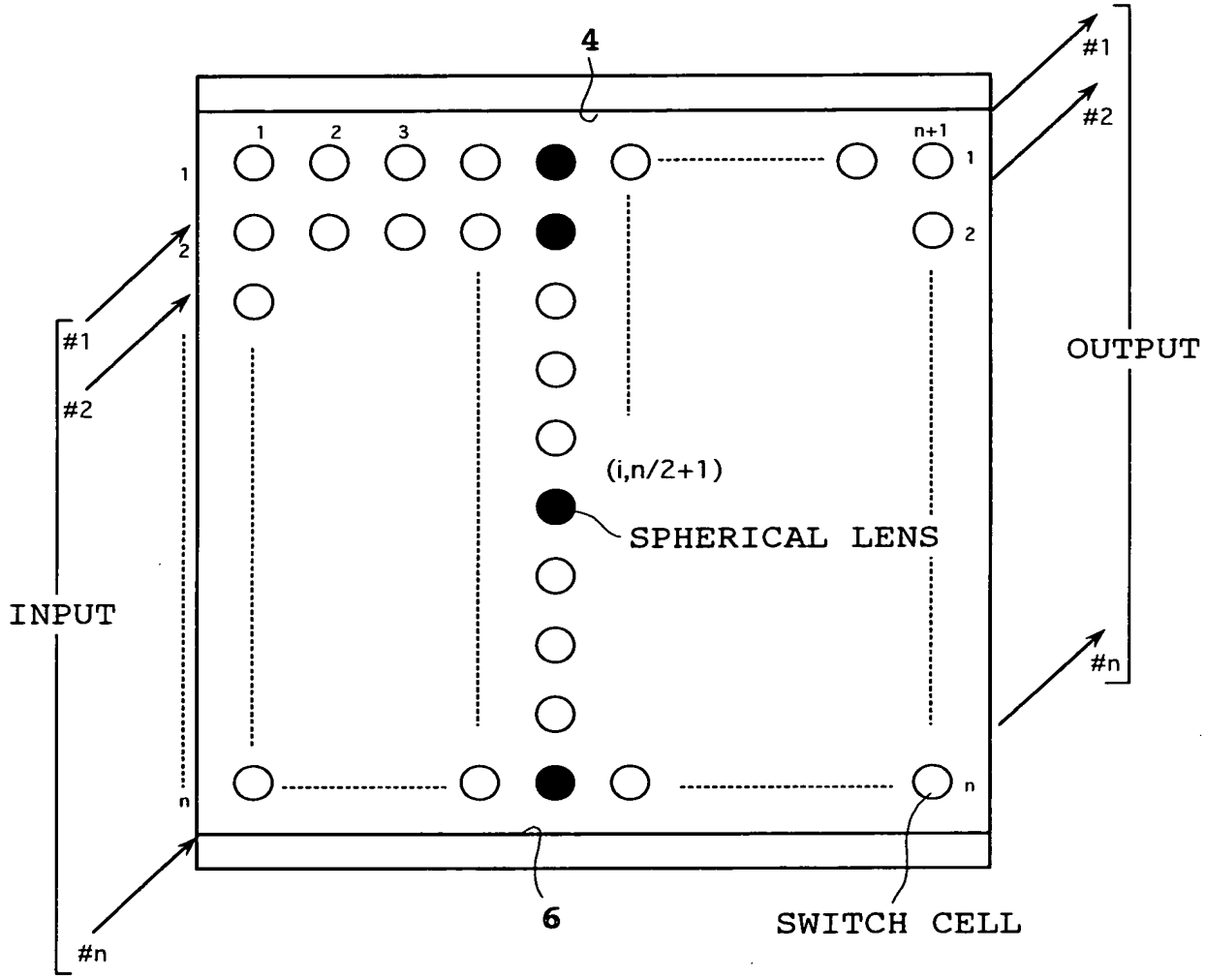
FIG.20



⊗ SIMULTANEOUS BIDIRECTIONAL REFLECTION MIRROR

EP 0 809 124 A1

FIG.21


4
#1
#2
1
2
3
n+1
1
2
1
2
#1
#2
OUTPUT
(i,n/2+1)
SPHERICAL LENS
INPUT
#n
n
n
6
SWITCH CELL
#n

JP06060250A

FIG.22

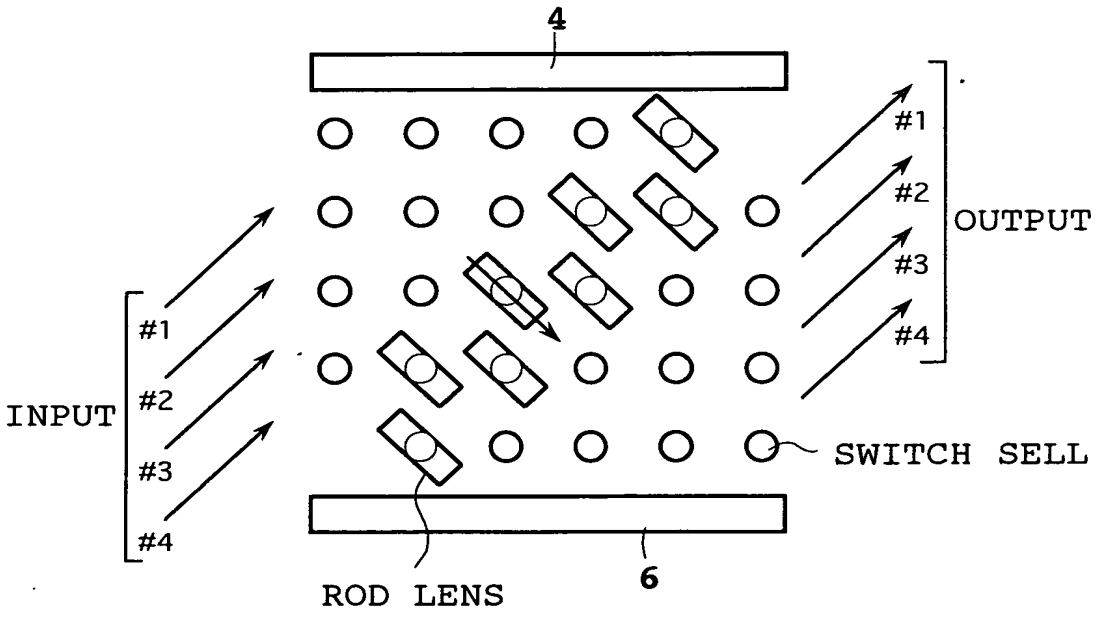


FIG.23

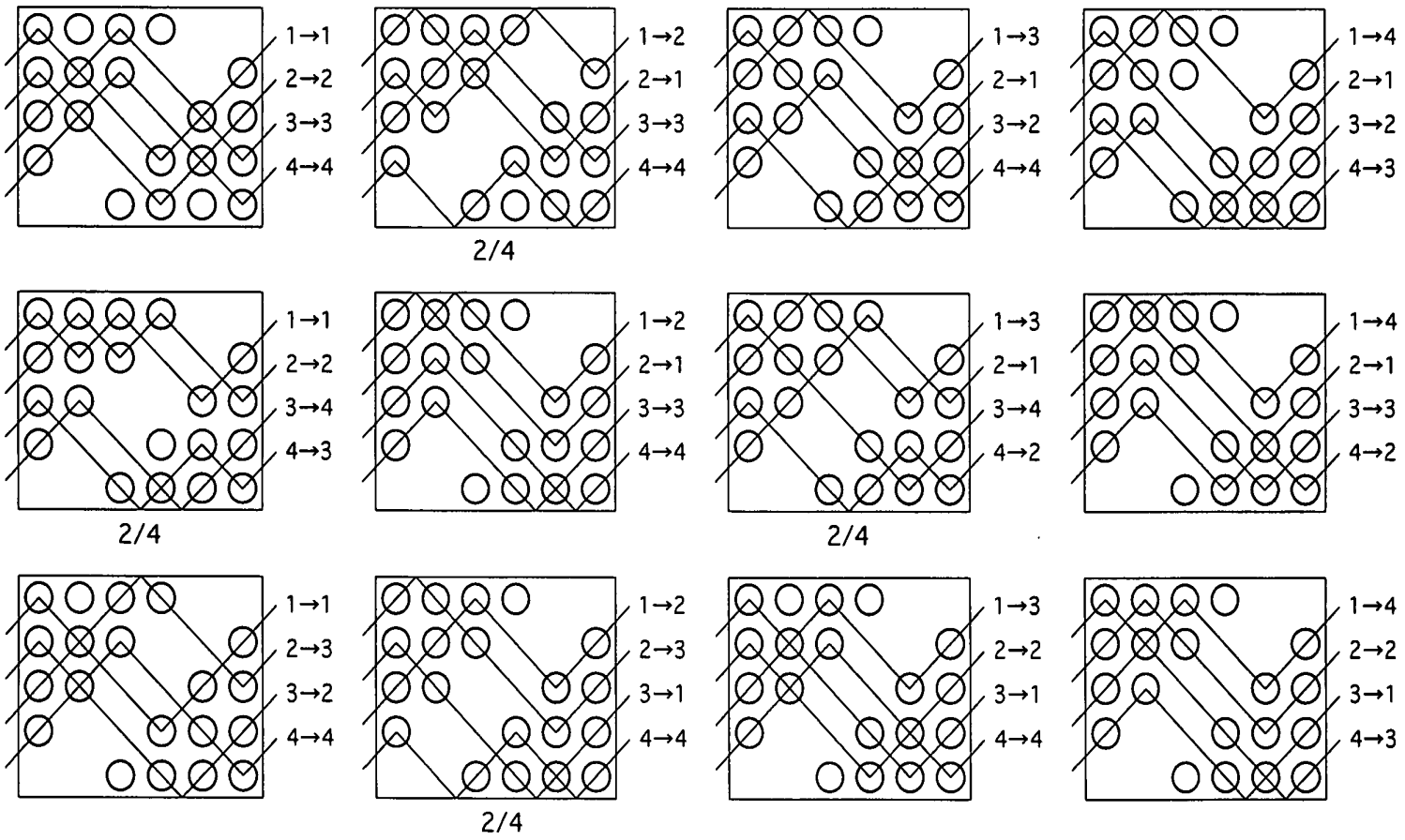
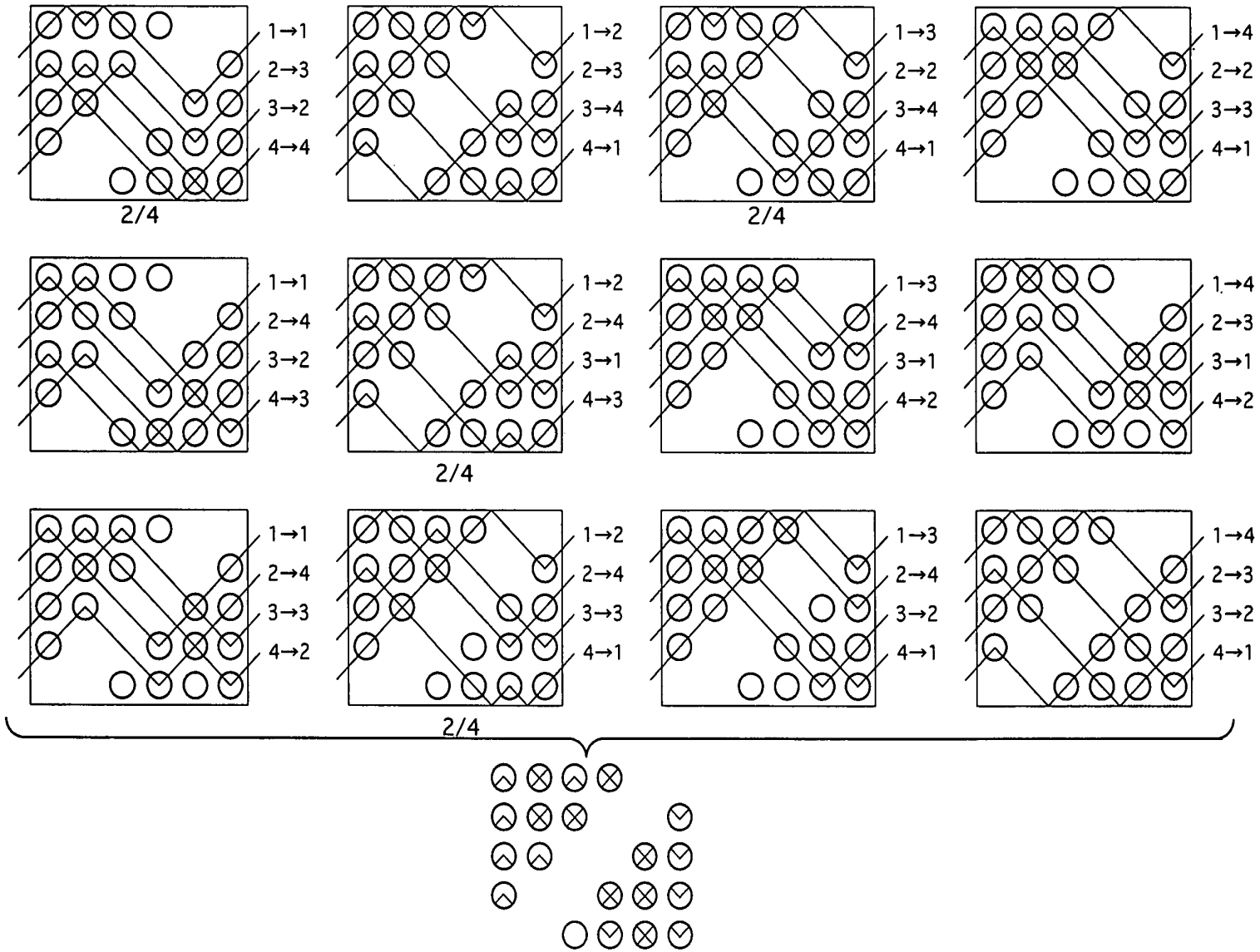
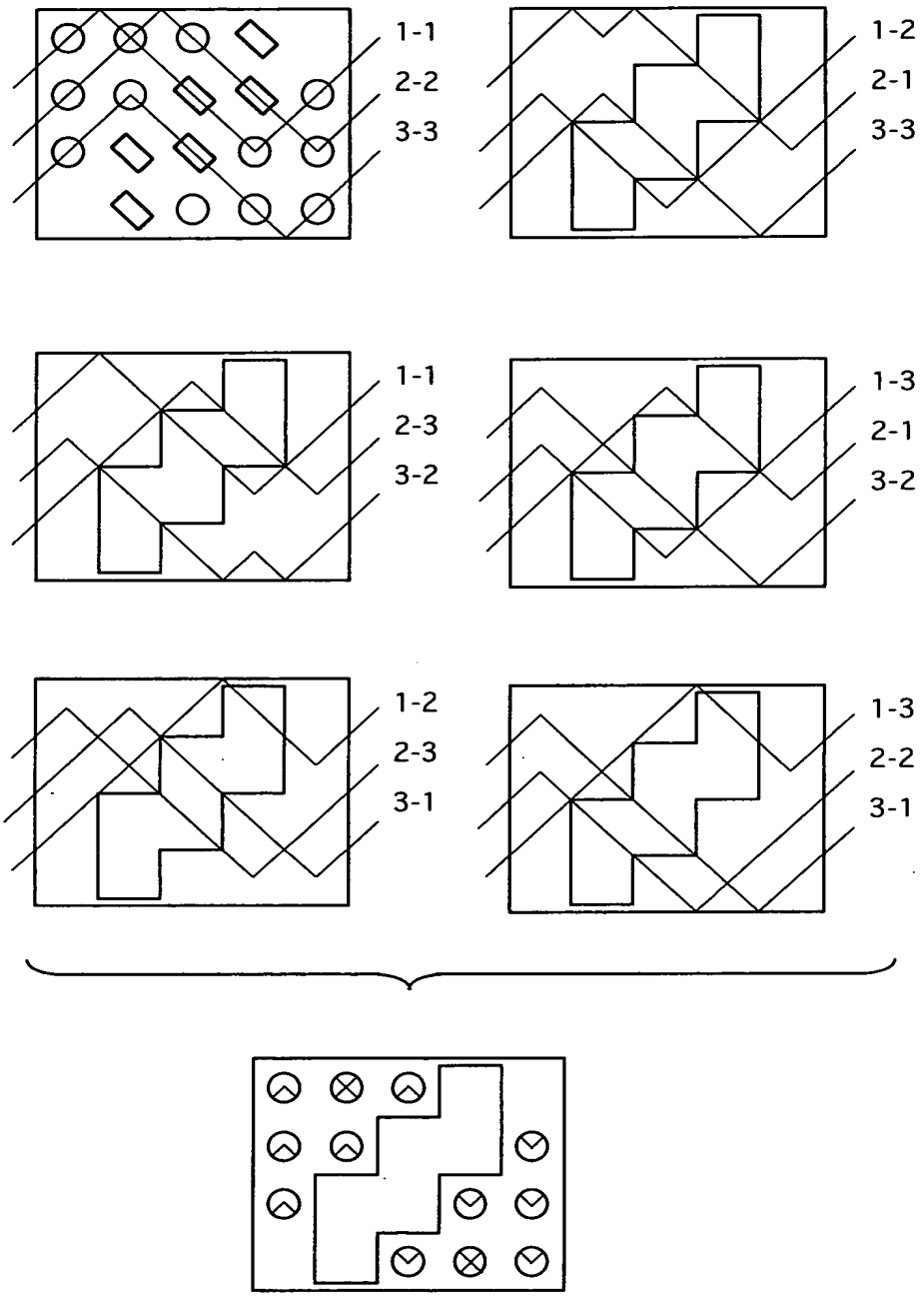

1→1
2→2
3→3
4→4
1→2
2→1
3→3
4→4
1→3
2→1
3→2
4→4
1→4
2→1
3→2
4→3
2/4
1→1
2→2
3→4
4→3
1→2
2→1
3→3
4→4
1→3
2→1
3→4
4→2
1→4
2→1
3→3
4→2
2/4
2/4
1→1
2→3
3→2
4→4
1→2
2→3
3→1
4→4
1→3
2→2
3→1
4→4
1→4
2→2
3→1
4→3
2/4

FIG.24


1→1
2→3
3→2
4→4
1→2
2→3
3→4
4→1
1→3
2→2
3→4
4→1
1→4
2→2
3→3
4→1
2/4
2/4
1→1
2→4
3→2
4→3
1→2
2→4
3→1
4→3
1→3
2→4
3→1
4→2
1→4
2→3
3→1
4→2
2/4
1→1
2→4
3→3
4→2
1→2
2→4
3→3
4→1
1→3
2→4
3→2
4→1
1→4
2→3
3→2
4→1
2/4

EP 0 680 809 A2

FIG.25



JP09246906 '090901

FIG.26

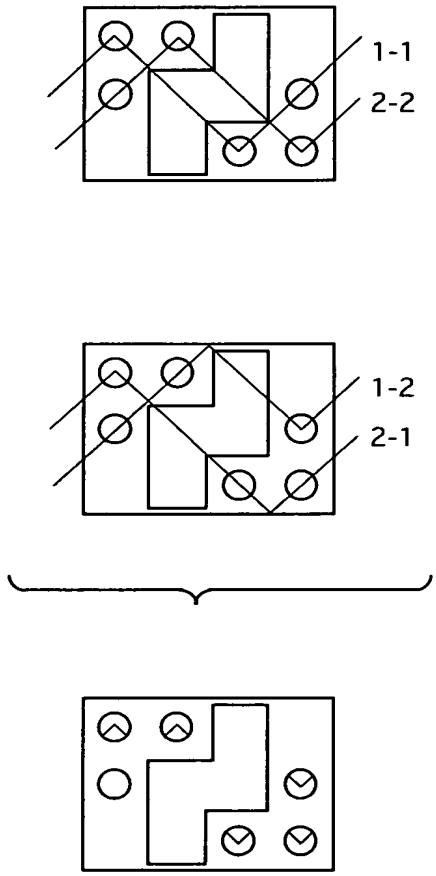


FIG.27

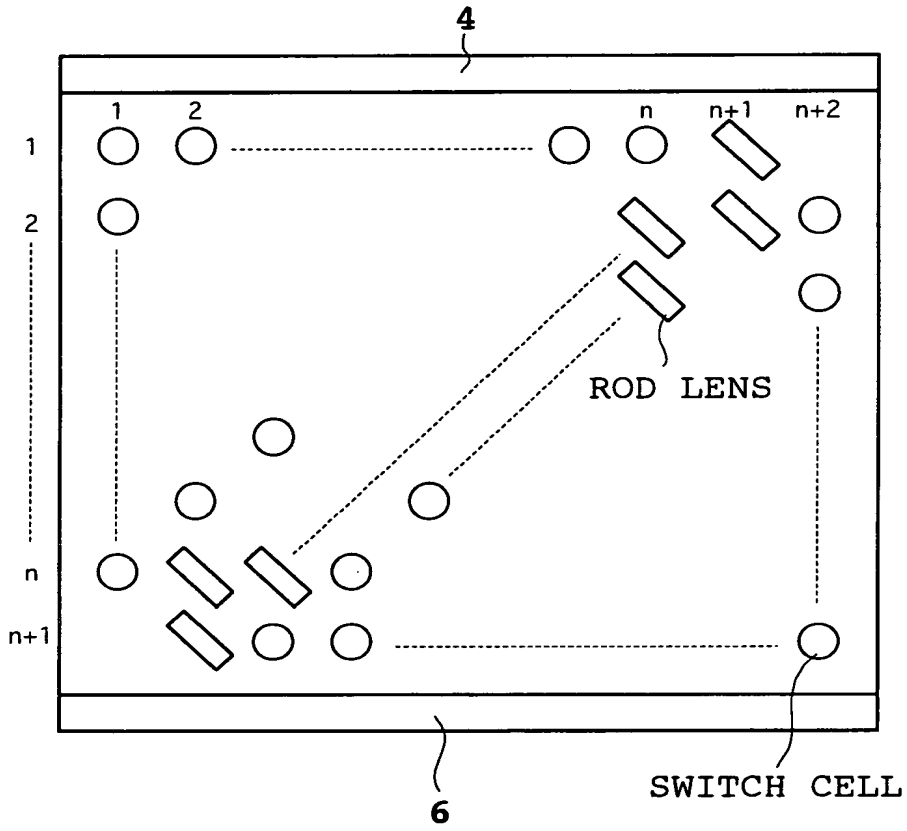
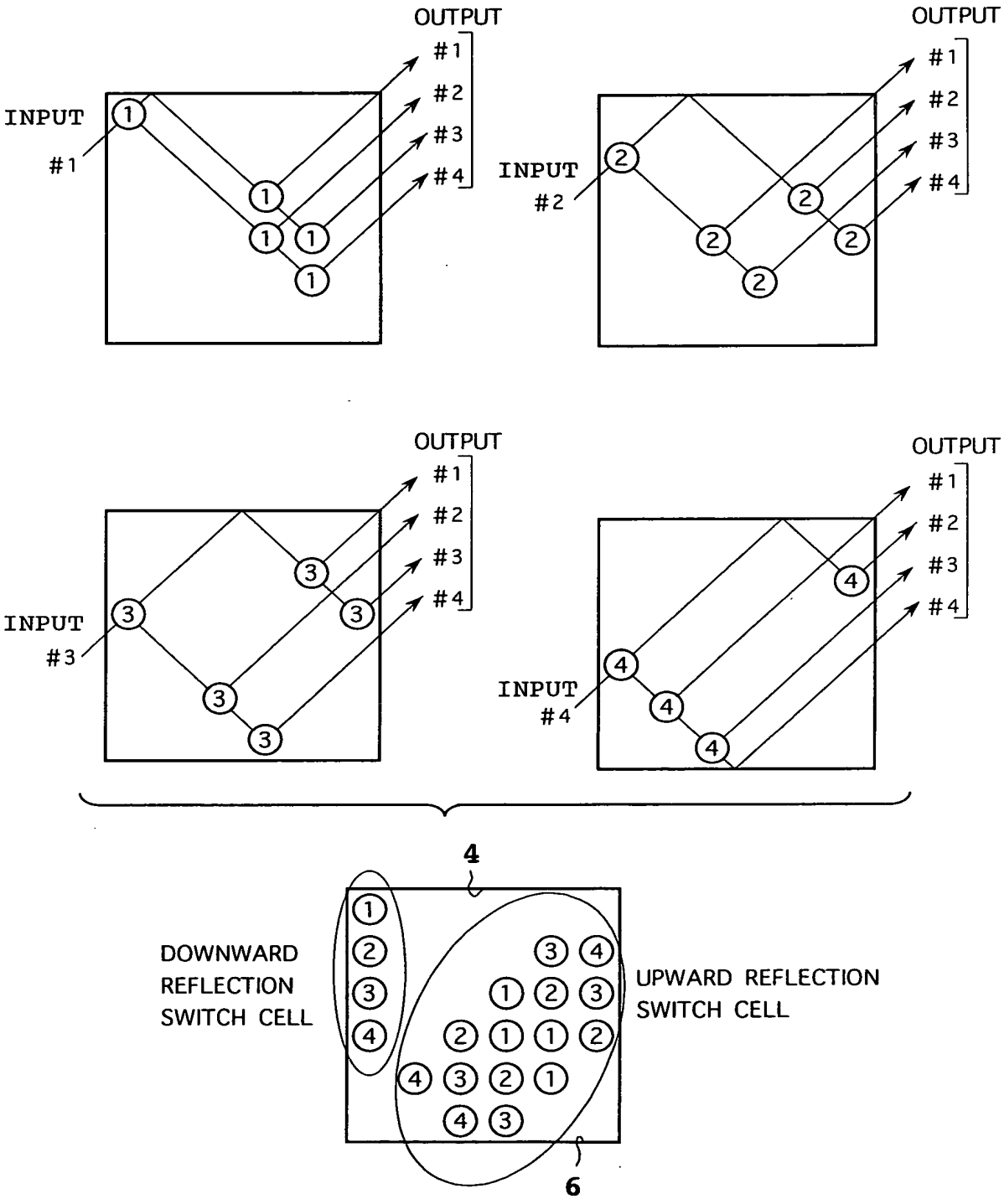


FIG.28


OUTPUT
#1
#2
#3
#4
INPUT
#1
INPUT
#2
INPUT
#3
INPUT
#4
4
6
DOWNWARD
REFLECTION
SWITCH CELL
UPWARD REFLECTION
SWITCH CELL

0094205 .0000 04

FIG.29

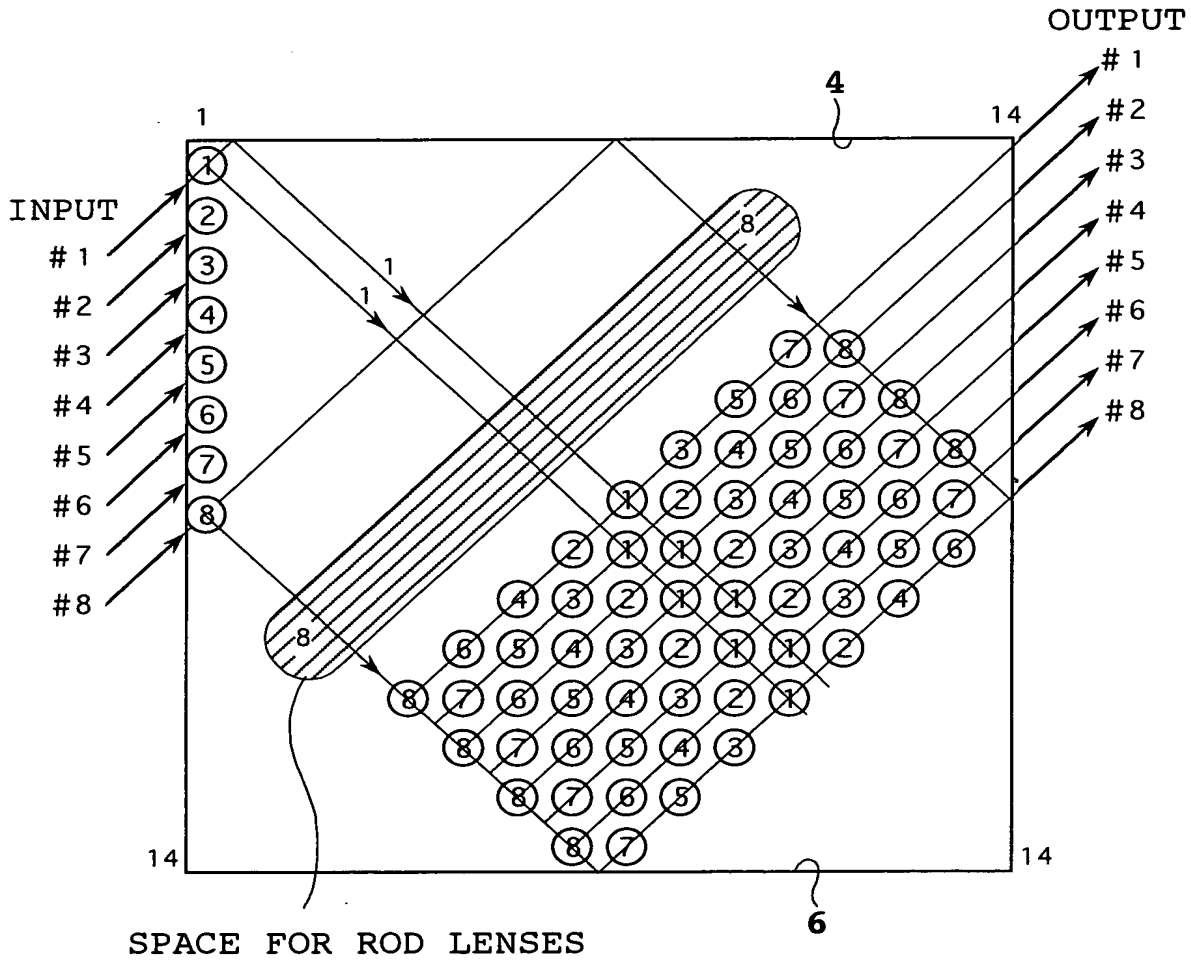
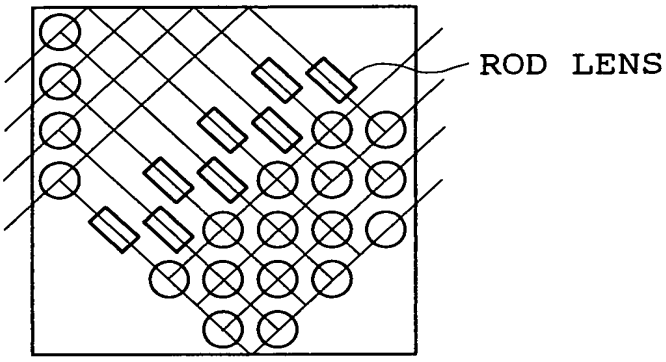
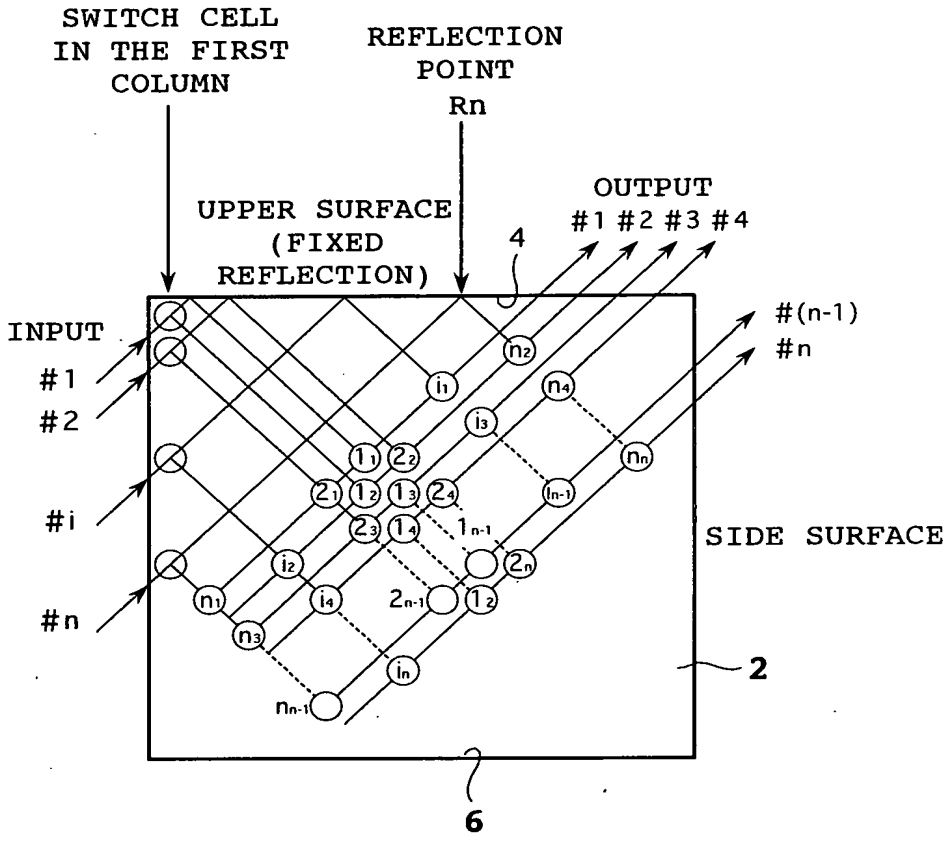


FIG.30



JP2004205960A

FIG.31



ⓘn : UPWARD REFLECTION SWITCH CELL FOR CONNECTING INPUT CHANNEL #i TO OUTPUT CHANNEL #n

FIG.32

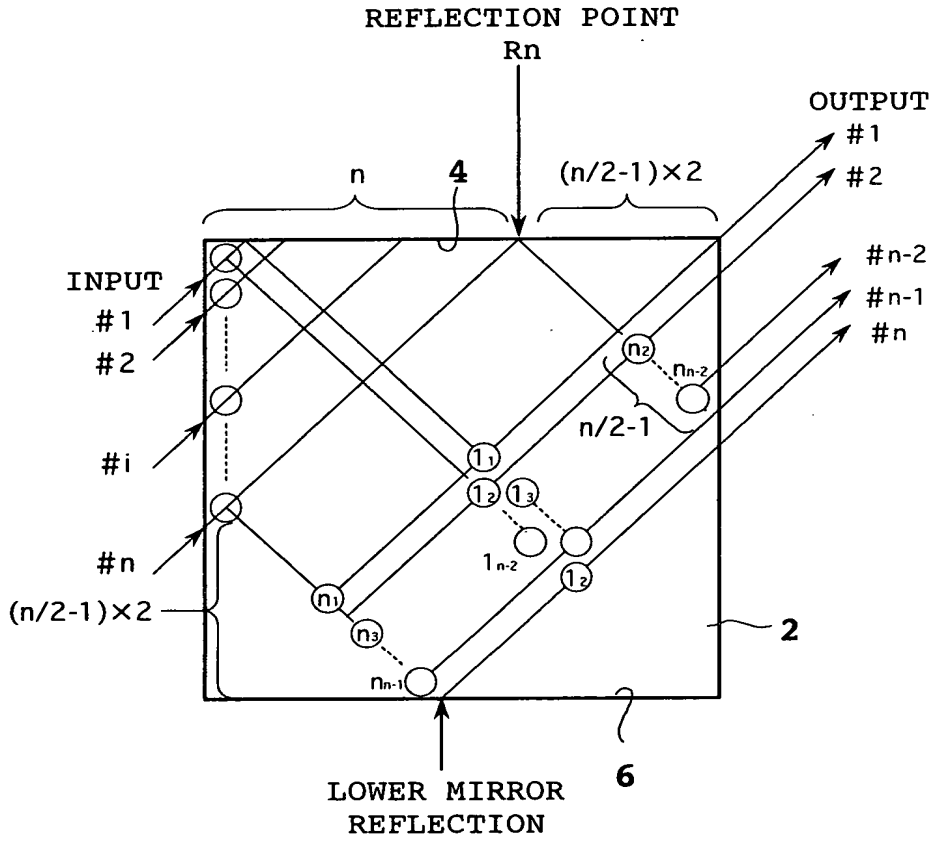

REFLECTION POINT
Rn
OUTPUT
#1
#2
#n-2
#n-1
#n
n
4
(n/2-1)×2
INPUT
#1
#2
#i
#n
(n/2-1)×2
n/2-1
2
6
LOWER MIRROR
REFLECTION

FIG.33

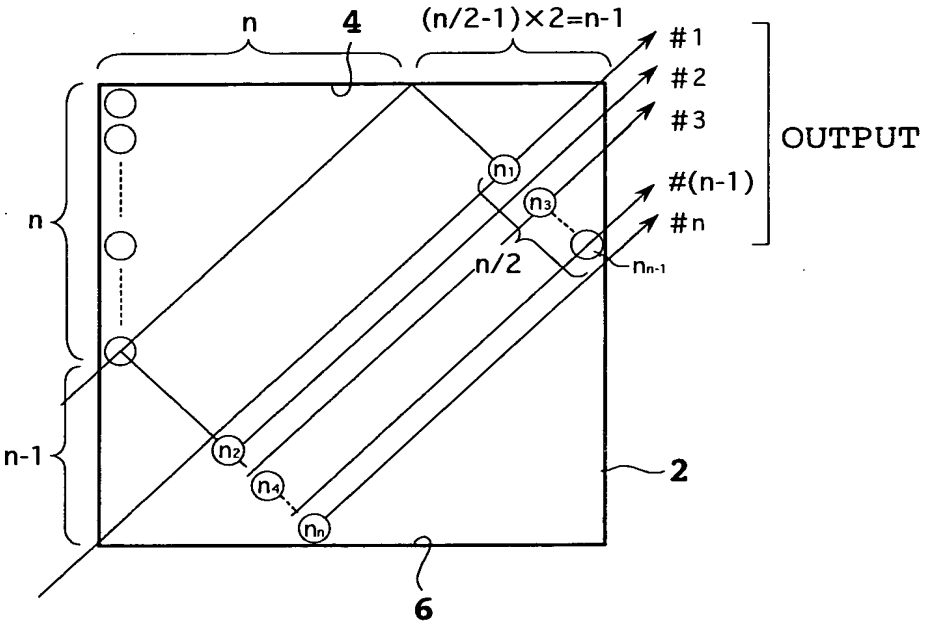


FIG.34

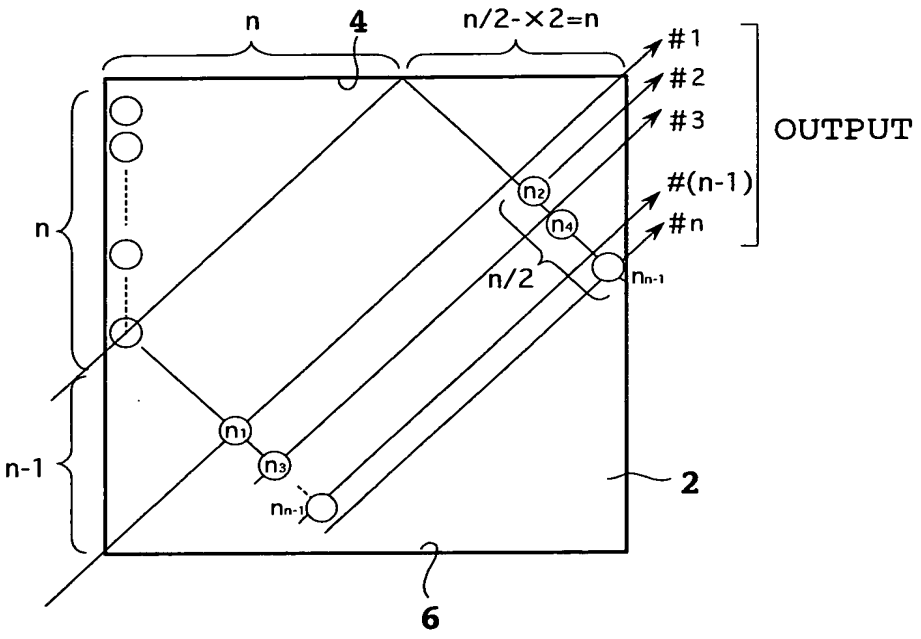


FIG.35

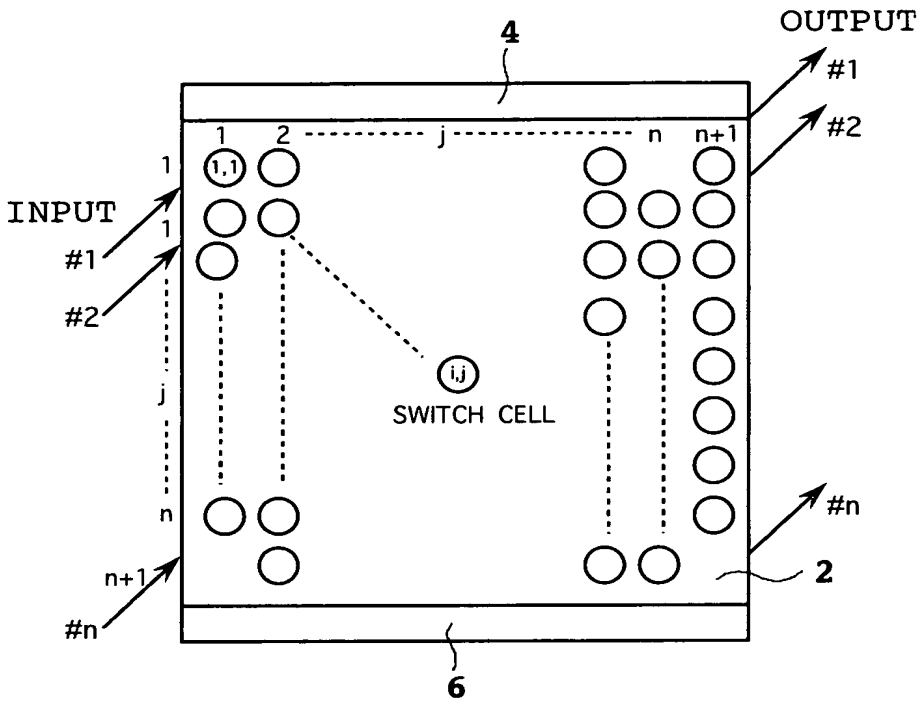


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FIG.36

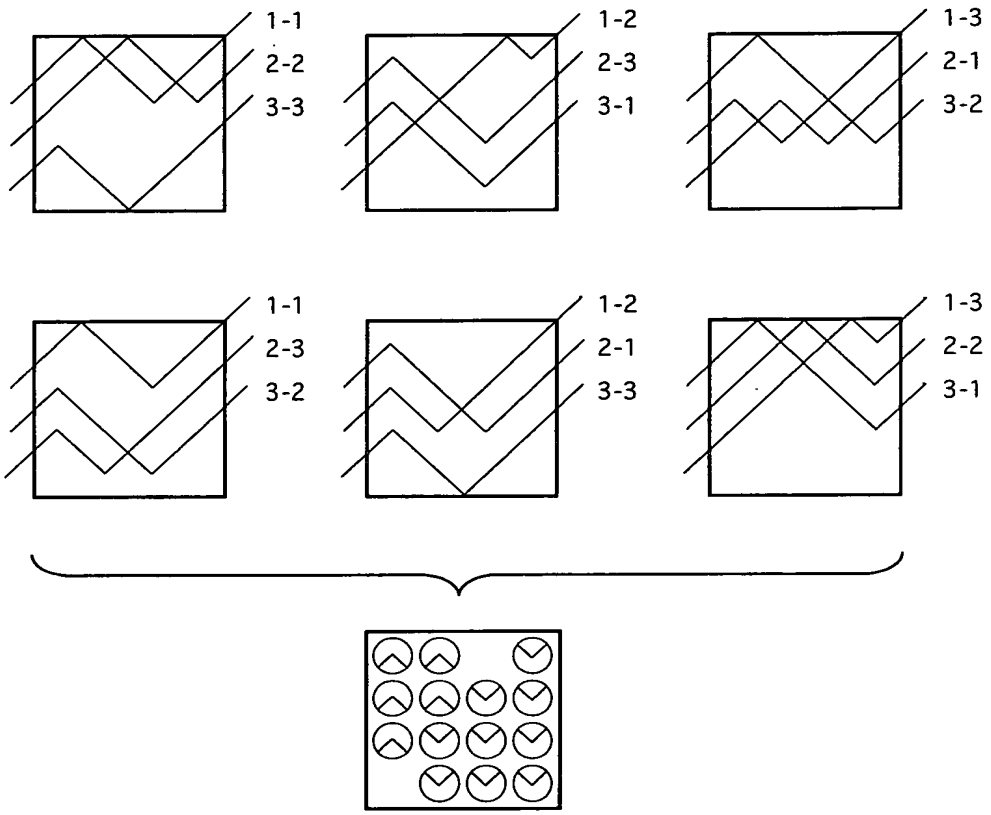
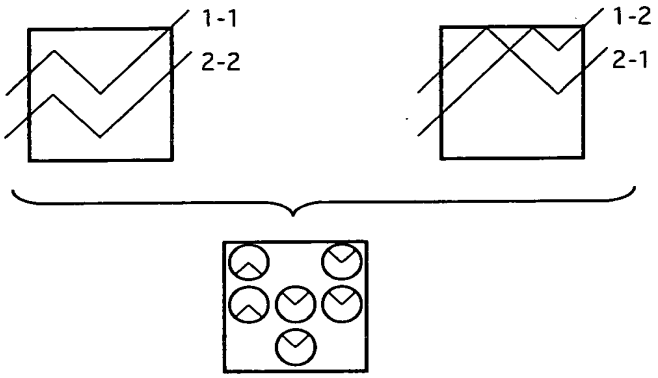


FIG.37



2 x 2 OPTICAL SWITCH

SIZE; 3 x 3
OPTICAL PATH LENGTH; 3
NUMBER OF CELLS; 6
NUMBER OF UPWARD REFLECTION MIRRORS; 4
NUMBER OF DOWNWARD REFLECTION MIRRORS; 2
NUMBER OF REFLECTIONS ; ALWAYS 2

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FIG.38

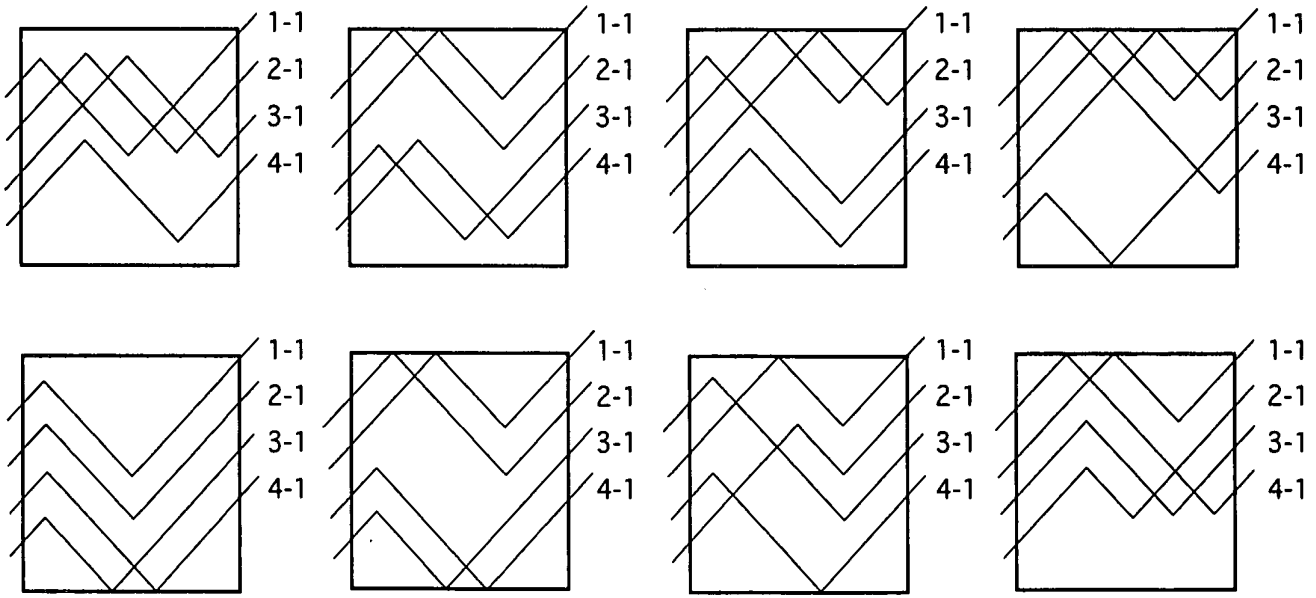

1-1
2-1
3-1
4-1
1-1
2-1
3-1
4-1
1-1
2-1
3-1
4-1
1-1
2-1
3-1
4-1
1-1
2-1
3-1
4-1
1-1
2-1
3-1
4-1
1-1
2-1
3-1
4-1
1-1
2-1
3-1
4-1

FIG.39

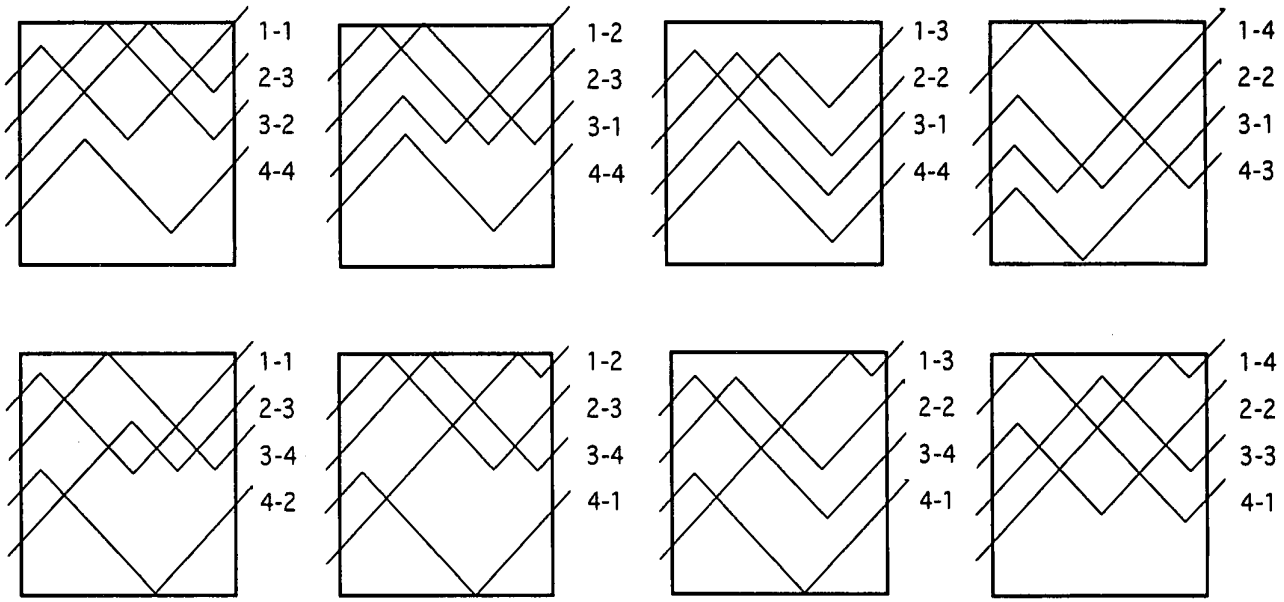

1-1
2-3
3-2
4-4
1-2
2-3
3-1
4-4
1-3
2-2
3-1
4-4
1-4
2-2
3-1
4-3
1-1
2-3
3-4
4-2
1-2
2-3
3-4
4-1
1-3
2-2
3-4
4-1
1-4
2-2
3-3
4-1

FIG.40

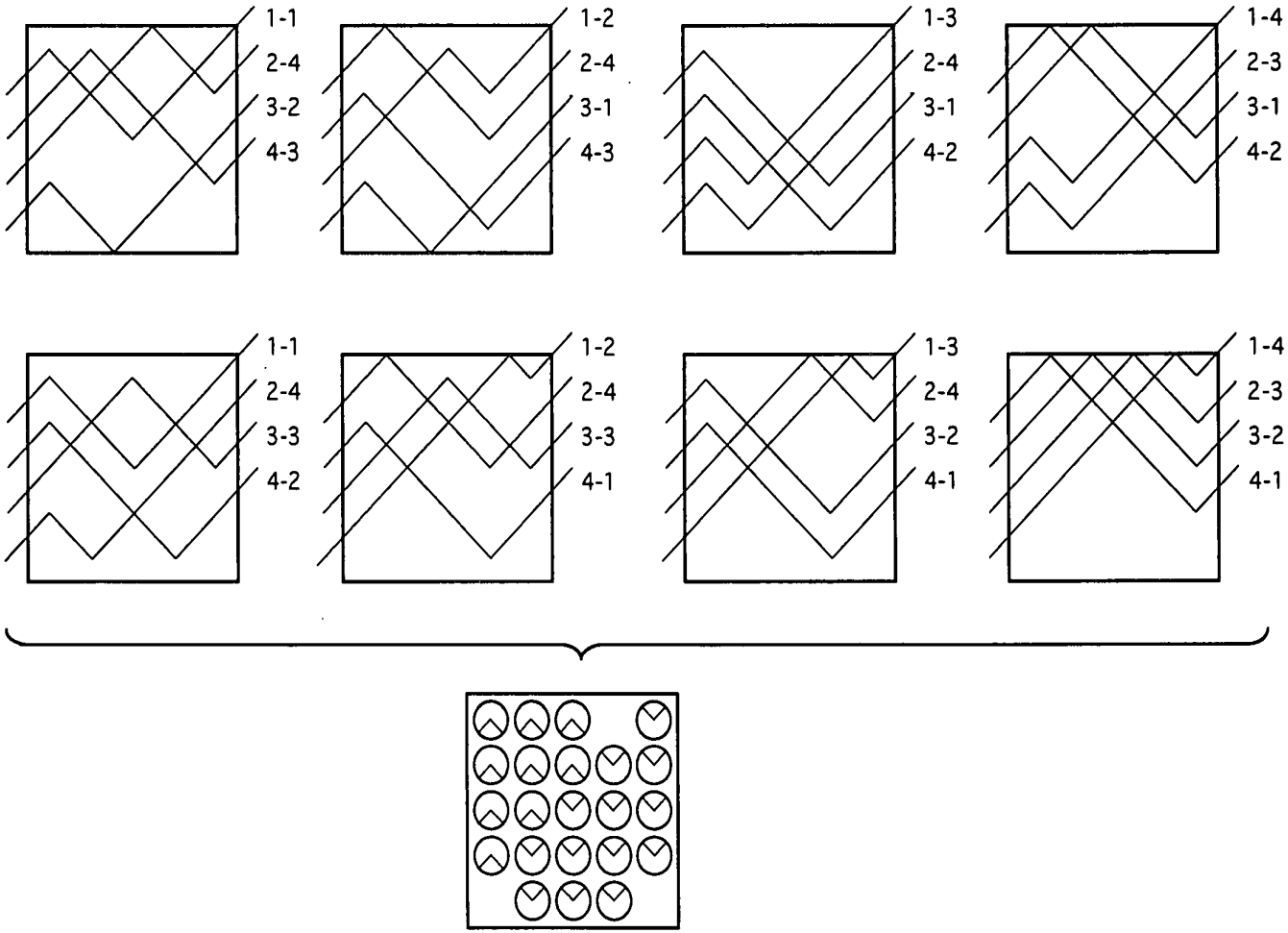

1-1
2-4
3-2
4-3
1-2
2-4
3-1
4-3
1-3
2-4
3-1
4-2
1-4
2-3
3-1
4-2
1-1
2-4
3-3
4-2
1-2
2-4
3-3
4-1
1-3
2-4
3-2
4-1
1-4
2-3
3-2
4-1

FIG.41

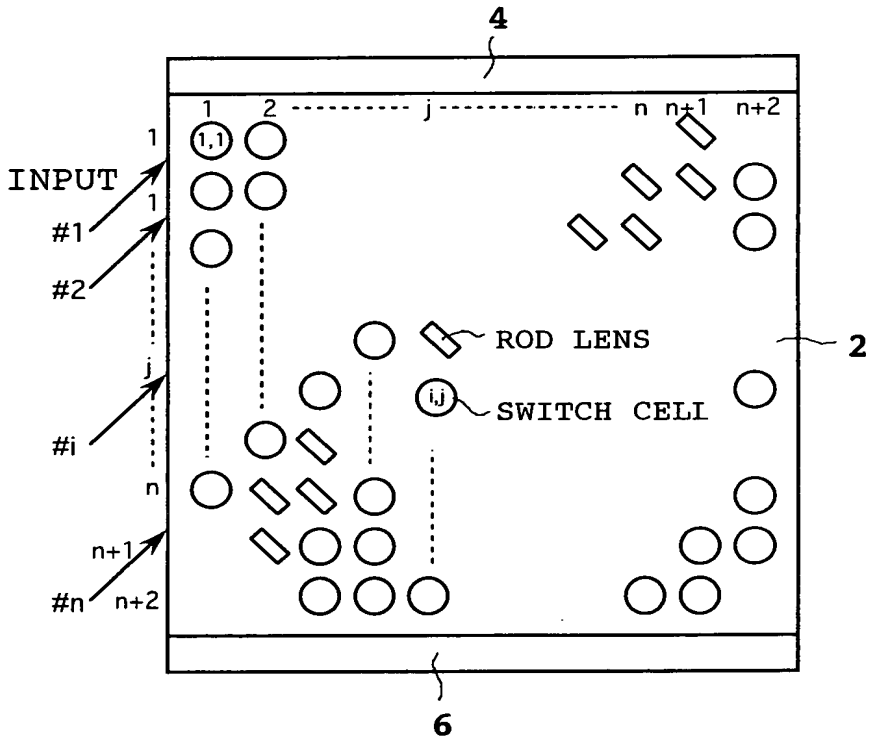


FIG.42

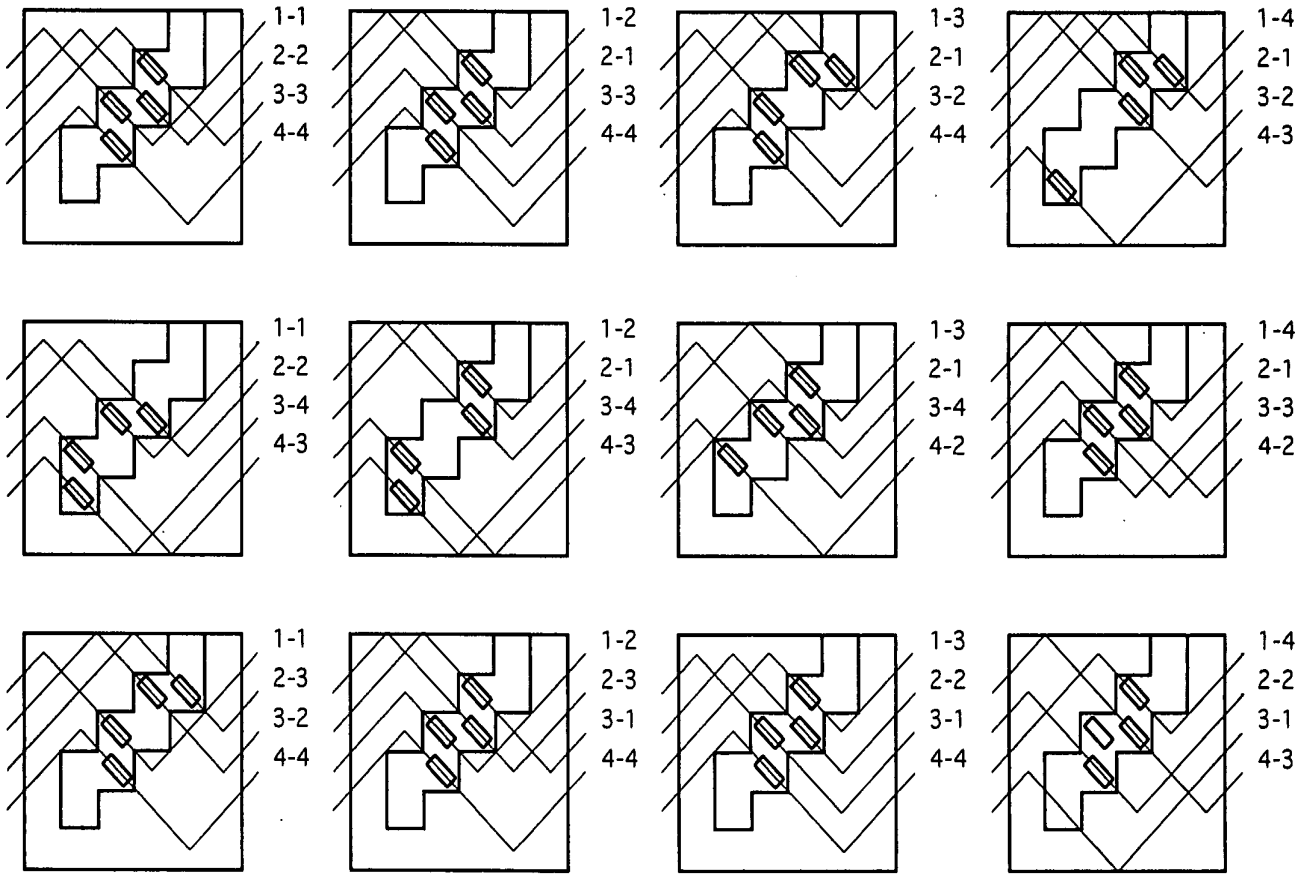

1-1
2-2
3-3
4-4
1-2
2-1
3-3
4-4
1-3
2-1
3-2
4-4
1-4
2-1
3-2
4-3
1-1
2-2
3-4
4-3
1-2
2-1
3-4
4-3
1-3
2-1
3-4
4-2
1-4
2-1
3-3
4-2
1-1
2-3
3-2
4-4
1-2
2-3
3-1
4-4
1-3
2-2
3-1
4-4
1-4
2-2
3-1
4-3

FIG.43

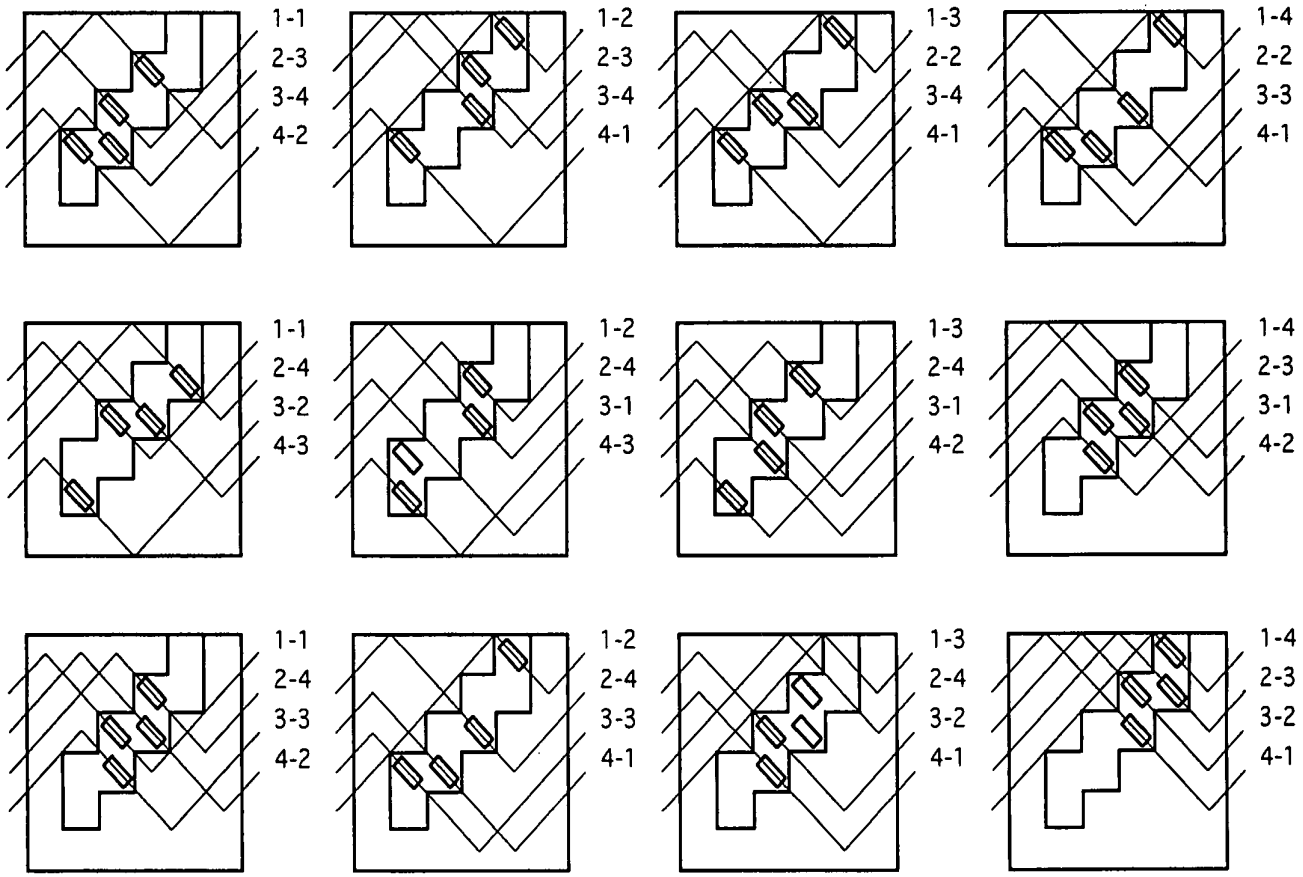
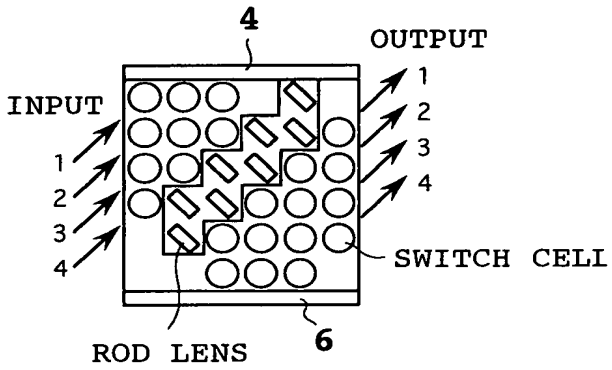

1-1
2-3
3-4
4-2
1-2
2-3
3-4
4-1
1-3
2-2
3-4
4-1
1-4
2-2
3-3
4-1
1-1
2-4
3-2
4-3
1-2
2-4
3-1
4-3
1-3
2-4
3-1
4-2
1-4
2-3
3-1
4-2
1-1
2-4
3-3
4-2
1-2
2-4
3-3
4-1
1-3
2-4
3-2
4-1
1-4
2-3
3-2
4-1

FIG.44



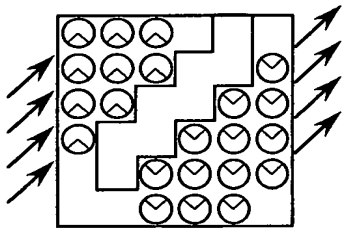


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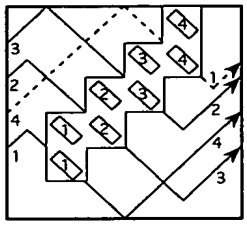
FIG.45



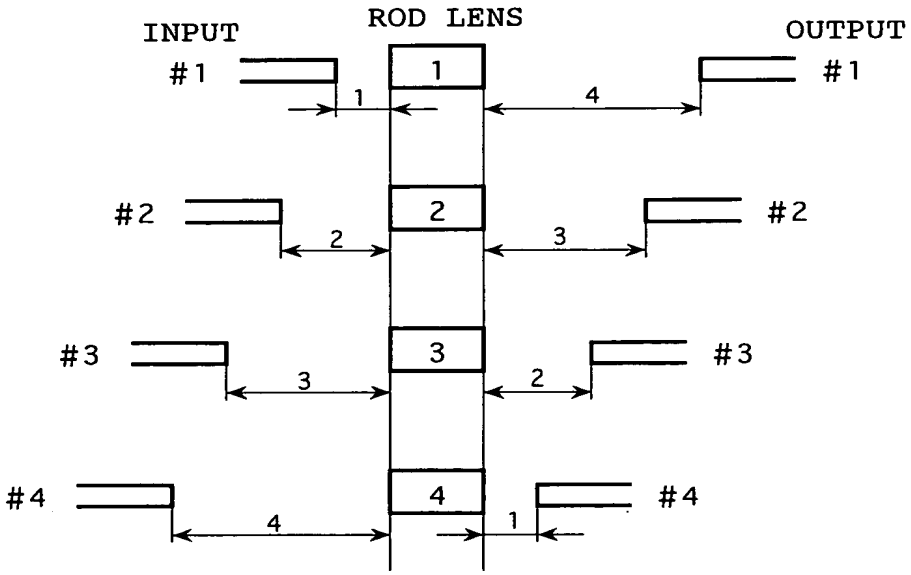


FIG.46

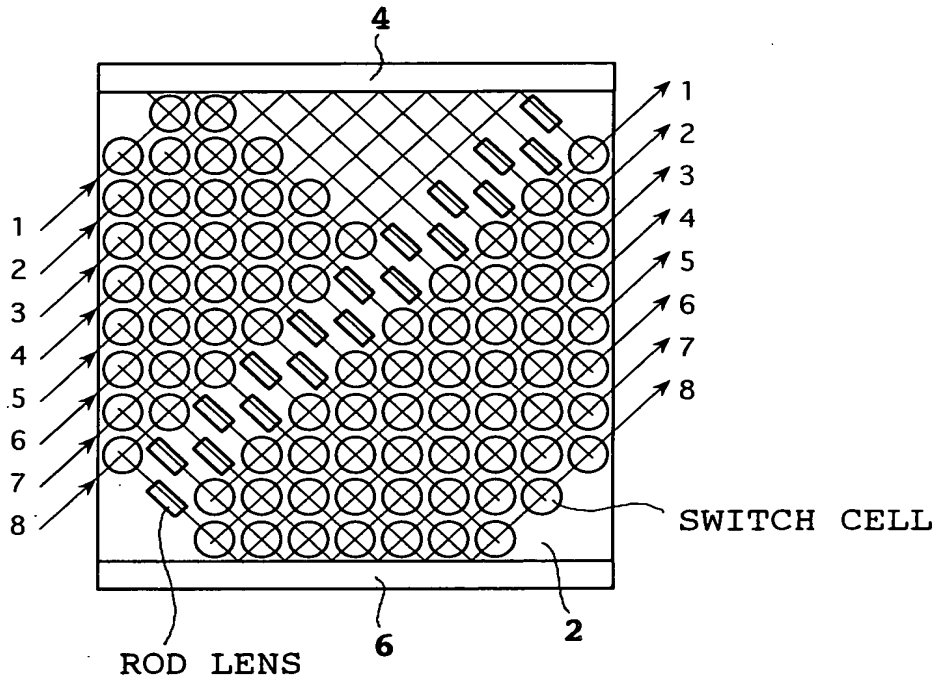
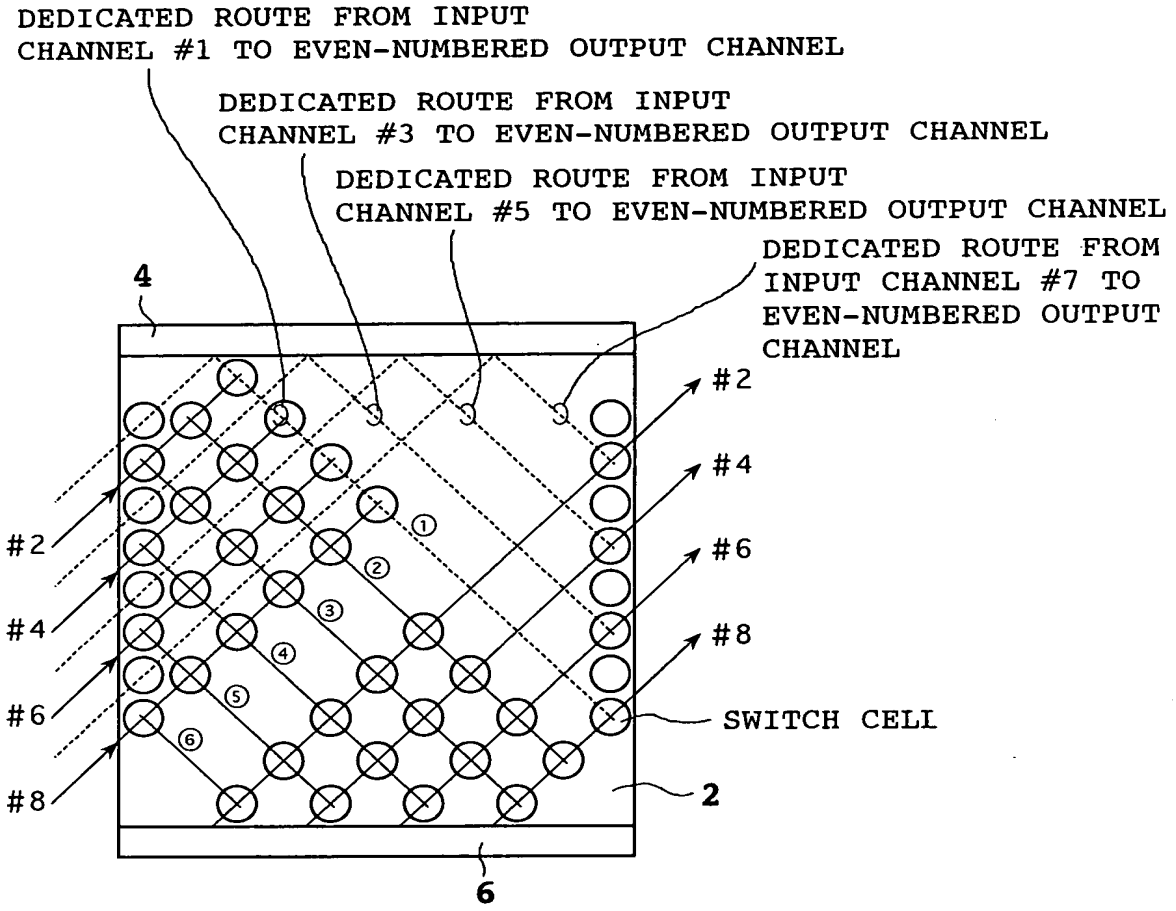


FIG.47



①, ②, ③ : ROUTES TO OUTPUT CHANNELS #2, #4, #6, AND #8

④ : ROUTES TO OUTPUT CHANNELS #2, #4, AND #6

⑤ : ROUTES TO OUTPUT CHANNELS #2, AND #4

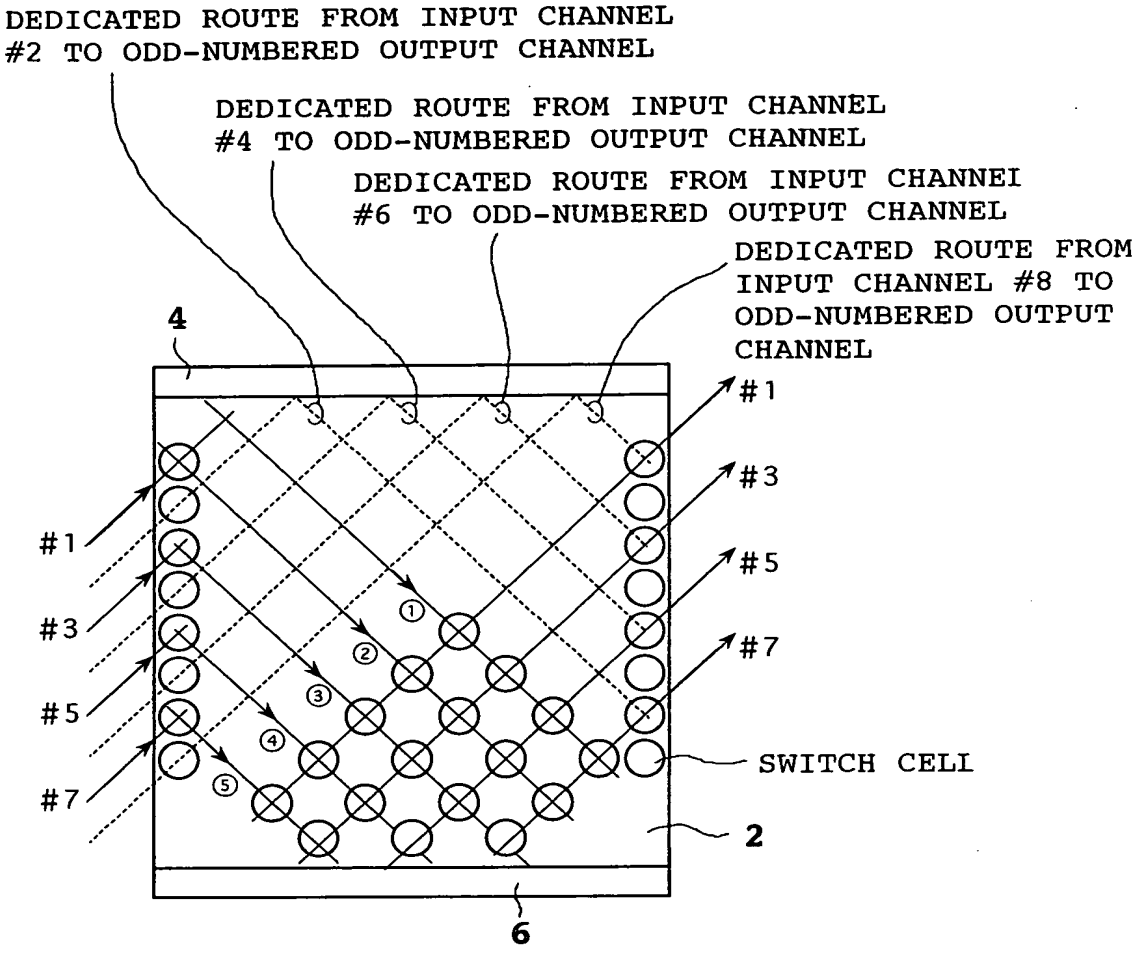
⑥ : ROUTES TO OUTPUT CHANNELS #2

INPUT CHANEL	ROUTE TO EVEN-NUMBERED OUTPUT CHANNEL
2	①/②/③
4	①/②/③ ,④
6	①/②/③ ,④,⑤
8	①/②/③ ,④,⑤,⑥

INPUT CHANNEL	OUTPUT CHANNEL	ROUTE
2	2	① or ② or ③
4	4	① or ② or ③ ④
6	6	① or ② or ③
8	8	

0924606.080901

FIG.48



①, ② : ROUTES TO OUTPUT CHANNELS #1, #3, #5, AND #7

③ : ROUTES TO OUTPUT CHANNELS #1, #3, #5 AND #7 WHEN INPUT CHANNEL IS #3, #5, OR #7

④ : ROUTES TO OUTPUT CHANNELS #1, #3, AND #5

⑤ : ROUTES TO OUTPUT CHANNELS #1 AND #3

INPUT CHANEL	ROUTE TO ODD-NUMBERED OUTPUT CHANNEL
1	①/②
3	①/② ,③
5	①/② ,③,④
7	①/② ,③,④,⑤

INPUT CHANNEL	OUTPUT CHANNEL	ROUTE
1	1	① or ②
3	3	③
5	5	④
7	7	① or ②

FIG.49

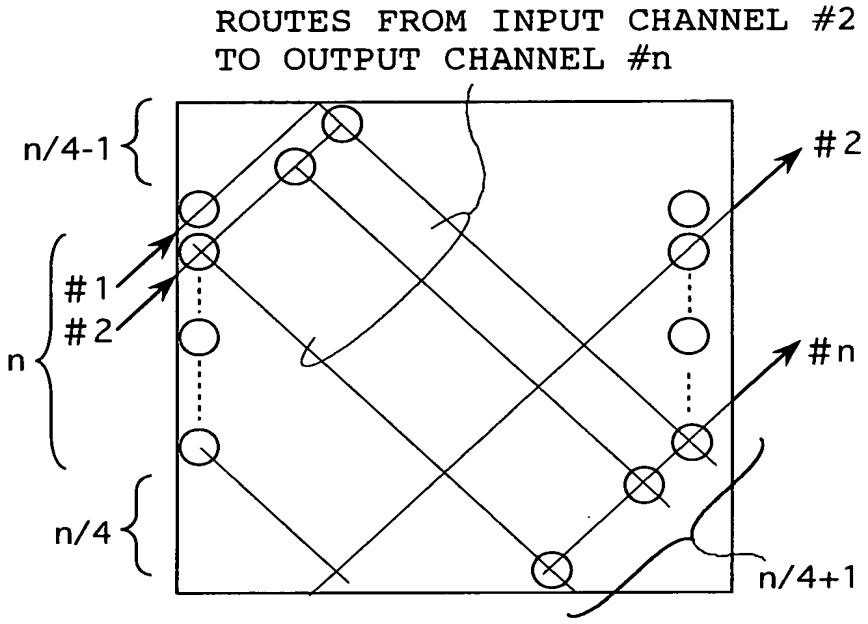
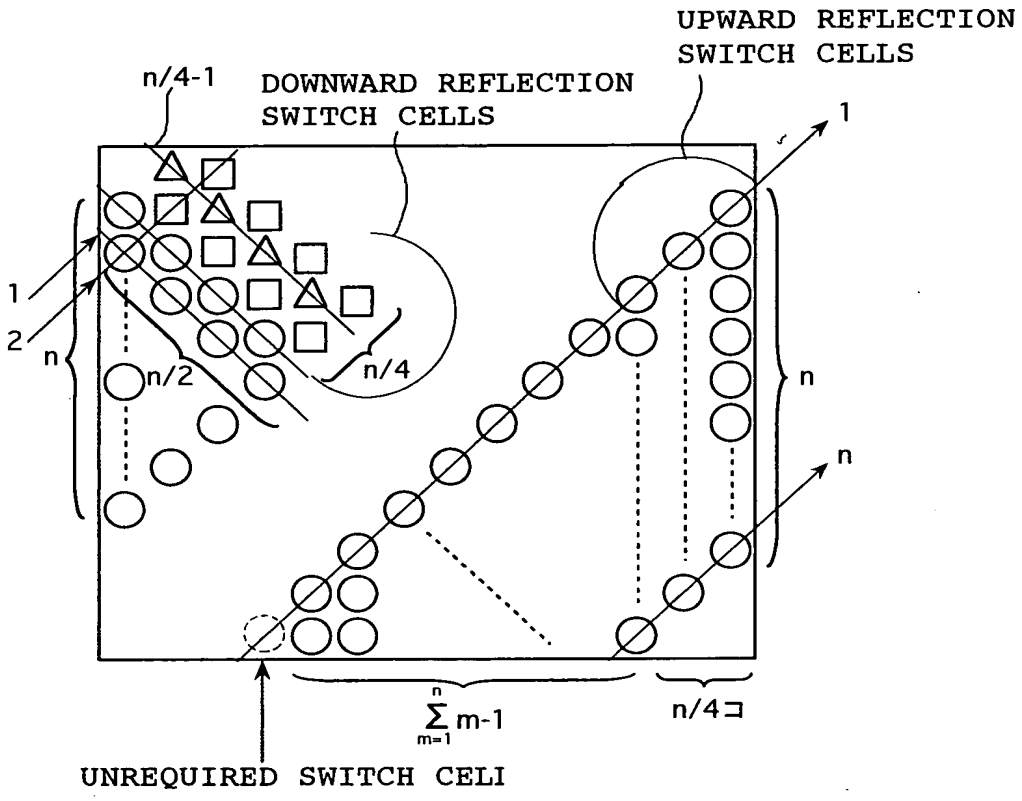

ROUTES FROM INPUT CHANNEL #2
TO OUTPUT CHANNEL #n
n/4-1
#1
#2
n
n/4
#2
#n
n/4+1

FIG.50

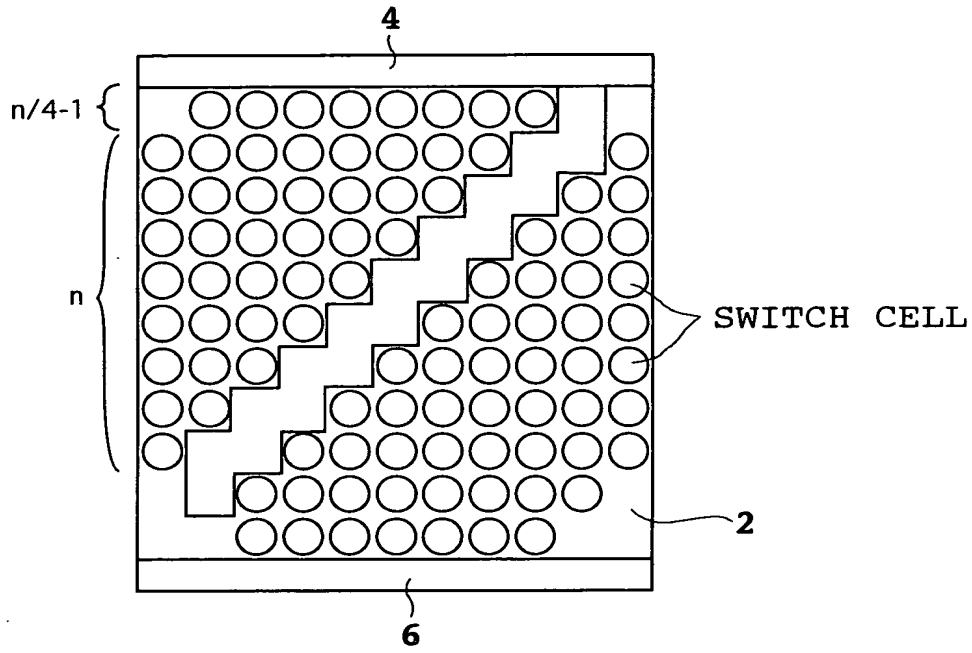


NUMBER OF UPWARD REFLECTION SWITCH CELLS : $\sum_{m=1}^{n} m-1+\frac{n}{4}\times n=\frac{n(n+1)}{2}-1+\frac{n^2}{4}=\frac{3}{4}n^2+\frac{1}{2}n-1$

NUMBER OF DOWNWARD REFLECTION SWITCH CELLS : $\underbrace{2\cdot\sum_{m=1}^{n/2} m}_{\text{○ SHOWN IN LEFT UPER PORTION OF THE FIGURE}}+\underbrace{\frac{n}{4}\times\frac{n}{2}}_{\text{□ SHOWN IN THE FIGURE}}+\underbrace{(\frac{n}{4}-1)\times\frac{n}{2}}_{\text{△ SHOWN IN THE FIGURE}}=\frac{n^2}{2}$

NUMBER OF ALL SWITCH CELLS : $\frac{5}{4}n^2+\frac{1}{2}n-1$

FIG.51



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